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ENERGY RESEARCH ABSTRACTS

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The Department of Energy's Scientific and Technical Information Program (STIP) is carried out at many levels within the Department and by its contractor organizations. The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, provides direction and leadership for STIP and serves as DOE's national center for scientific and technical information management and dissemination. Both DOE-originated information and worldwide literature regarding advances in subjects of interest to DOE researchers are collected, processed, and disseminated through an energy information system maintained by OSTI. The major data bases in this system are available within the United States through commercial on-line systems and to those outside the United States through formal governmental exchange agreements. The current-year records for the major data bases, plus a number of specialized data bases are available to DOE offices and contractors through OSTI's Integrated Technical Information System (ITIS). ITIS also serves as a gateway to other government and commercial systems and provides information merging for customized information products. To manage DOE's information resources effectively, DOE's Scientific and Technical Information Program is one of continual development and evaluation of new information products, systems, and technologies.

ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. **The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.**

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

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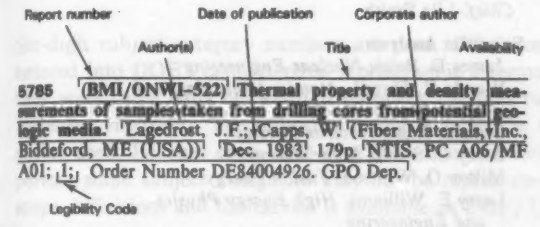
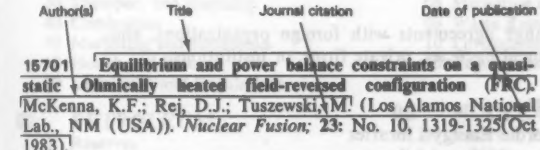
The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.



5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; 1; Order Number DE84004926. GPO Dep.

Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.



15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). *Nuclear Fusion;* 23: No. 10, 1319-1325 (Oct 1983).

Abstract

Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA).* Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

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Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS Order Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order number–report number correlation is included for convenience.

BMI/ONWI-522	9:5785	NTIS, PC A09/MF A01. Order Number DE84004926, Distribution Category MN-70

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CEA Centre d'Etudes de Saclay
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Karlsruhe, Federal Republic of Germany

IEA Biomass Conversion Service
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Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts,* Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

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01 COAL AND COAL PRODUCTS
- 03 Preparation
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Legislation and Regulations

02 PETROLEUM
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

03 NATURAL GAS
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Aspects
- 09 Artificial Stimulation
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

04 OIL SHALES AND TAR SANDS
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

05 NUCLEAR FUELS
- 01 Reserves, Exploration, and Mining
- 04 Feed Processing
- 05 Uranium Enrichment
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing, Economics, and By-Products
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Safeguards, Inspection, and Accountability
- 60 Legislation and Regulations

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies
- 04 Economics

08 HYDROGEN
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

09 OTHER SYNTHETIC AND NATURAL FUELS
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste and Wood Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

13 HYDRO ENERGY
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power-Conversion Systems

14 SOLAR ENERGY
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Systems
- 07 Solar Thermal Power Systems
- 08 Ocean Energy Systems
- 09 Solar Thermal Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

15 GEOTHERMAL ENERGY
- 01 Resource Status and Assessment
- 02 Geology and Hydrology of Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 07 By-Products
- 08 Geothermal Power Plants
- 09 Geothermal Engineering
- 10 Direct Energy Utilization
- 20 Geothermal Data and Theory

16 TIDAL AND WAVE POWER
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 07 Tidal Power Plants
- 08 Wave Energy Converters

17 WIND ENERGY
- 01 Availability (Climatology)
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 06 Wind Energy Engineering

20 ELECTRIC POWER ENGINEERING
- 01 Power Plants and Power Generation
- 02 Environmental Control Technology
- 03 Power Transmission and Distribution

21 NUCLEAR POWER PLANTS
- 01 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Nonbreeding, Light-Water Moderated, Non-boiling Water Cooled
- 03 Power Reactors, Nonbreeding, Graphite Moderated
- 04 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated
- 05 Power Reactors, Breeding
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 07 Regulation and Licensing
- 08 Economics

22 NUCLEAR REACTOR TECHNOLOGY
- 01 Theory and Calculation
- 02 Components and Accessories
- 03 Fuel Elements
- 04 Control Systems
- 05 Environmental Aspects
- 06 Research, Test, and Experimental Reactors
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety

25 ENERGY STORAGE
- 01 Magnetic
- 02 Compressed Gas
- 03 Pumped Hydro
- 04 Capacitor Banks
- 05 Flywheels
- 06 Thermal
- 07 Liquefied Gas
- 08 Chemical
- 09 Batteries

29 ENERGY PLANNING AND POLICY
- 01 Energy Analysis and Modeling
- 02 Economics and Sociology
- 03 Environment, Health, and Safety
- 04 Natural Resources
- 05 Research, Development, Demonstration, and Commercialization
- 06 Nuclear Energy
- 07 Transport and Storage
- 08 Waste Heat Utilization
- 10 Conservation
- 20 Supply, Demand, and Forecasting
- 30 Policy, Legislation, and Regulation
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 60 Electric Power
- 80 Consumption and Utilization
- 90 Unconventional Sources and Power Generation

30 DIRECT ENERGY CONVERSION
- 01 MHD Generators
- 02 EHD Generators
- 03 Thermoelectric Generators
- 04 Thermionic Converters
- 05 Fuel Cells
- 08 Miscellaneous Converters

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
- 01 Buildings
- 02 Transportation
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 09 Education and Public Relations

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
- 01 Internal Combustion Engines
- 02 External Combustion Engines
- 03 Electric-Powered Systems
- 04 Hybrid Systems
- 05 Flywheel Propulsion
- 06 Vehicle Design Factors
- 07 Emission Control
- 08 Alternative Fuels

35 ARMS CONTROL
- 01 Policy, Negotiations, and Legislation
- 02 Proliferation
- 03 Verification

36 MATERIALS
- 01 Metals and Alloys
- 02 Ceramics, Cermets, and Refractories
- 06 Other Materials

40 CHEMISTRY
- 01 Analytical and Separations Chemistry
- 02 Inorganic, Organic, and Physical Chemistry
- 04 Electrochemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry
- 08 Combustion, Pyrolysis, and High-Temperature Chemistry

42 ENGINEERING
- 02 Facilities and Equipment
- 03 Lasers
- 04 Heat Transfer and Fluid Flow
- 05 Materials Testing
- 08 Electronic Circuits and Devices
- 09 Waste Processing Plants and Equipment
- 10 Combustion Systems
- 20 Underground Engineering
- 30 Marine Engineering
- 40 Pollution Control Equipment
- 50 Power Cycles

43 PARTICLE ACCELERATORS
- 01 Design, Development, and Operation
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 03 Auxiliaries and Components
- 04 Storage Rings

44 INSTRUMENTATION
- 01 Radiation Instrumentation
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 03 Miscellaneous Instruments
- 04 Well Logging Instrumentation

45 EXPLOSIONS AND EXPLOSIVES
- 01 Chemical
- 02 Nuclear
- 03 Explosion Detection

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 01 Social and Economic Studies
- 02 Assessment of Energy Technologies

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology

55 BIOMEDICAL SCIENCES, BASIC STUDIES (CONT.)
04 Genetics
05 Metabolism
06 Medicine
07 Microbiology
08 Morphology
09 Pathology
10 Physiological Systems
20 Public Health
30 Agriculture and Food Technology

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
01 Radiation Effects
02 Thermal Effects
03 Chemicals Metabolism and Toxicology
04 Other Environmental Pollutant Effects

57 HEALTH AND SAFETY

58 GEOSCIENCES
01 Geology and Hydrology
02 Geophysics
03 Mineralogy, Petrology, and Rock Mechanics
04 Geochemistry
05 Oceanography

64 PHYSICS I
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

65 PHYSICS II
10 Nuclear Physics
12-20 Nuclear Properties and Reactions
30 Nuclear Theory
40 Radiation and Shielding Physics
50 Medical Physics
60 Condensed Matter Physics
61 Superconductivity
70 Theoretical and Mathematical Physics

70 FUSION ENERGY
01 Plasma Research
02 Fusion Power Plant Technology

99 GENERAL AND MISCELLANEOUS
01 Management
02 Mathematics and Computers
03 Information Handling
04 Law
05 Civilian Defense

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

ORDER NUMBER CORRELATION

SUBJECT CONTENTS (ALPHABETICAL LISTING)

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33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
- 08 Alternative Fuels
- 03 Electric-Powered Systems
- 07 Emission Control
- 02 External Combustion Engines
- 05 Flywheel Propulsion
- 04 Hybrid Systems
- 01 Internal Combustion Engines
- 06 Vehicle Design Factors

35 ARMS CONTROL
- 01 Policy, Negotiations, and Legislation
- 02 Proliferation
- 03 Verification

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
- 03 Chemicals Metabolism and Toxicology
- 04 Other Environmental Pollutant Effects
- 01 Radiation Effects
- 02 Thermal Effects

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 30 Agriculture and Food Technology
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 06 Medicine
- 05 Metabolism
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health

40 CHEMISTRY
- 01 Analytical and Separations Chemistry
- 08 Combustion, Pyrolysis, and High-Temperature Chemistry
- 04 Electrochemistry
- 02 Inorganic, Organic, and Physical Chemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry

01 COAL AND COAL PRODUCTS
- 05 By-Products
- 40 Combustion
- 09 Environmental Aspects
- 60 Health and Safety
- 70 Legislation and Regulations
- 50 Marketing and Economics
- 20 Mining
- 03 Preparation
- 04 Processing
- 06 Properties
- 10 Reserves and Exploration
- 30 Transport and Handling
- 08 Waste Management

30 DIRECT ENERGY CONVERSION
- 02 EHD Generators
- 05 Fuel Cells
- 01 MHD Generators
- 08 Miscellaneous Converters
- 04 Thermionic Converters
- 03 Thermoelectric Generators

20 ELECTRIC POWER ENGINEERING
- 02 Environmental Control Technology
- 01 Power Plants and Power Generation
- 03 Power Transmission and Distribution

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
- 01 Buildings
- 09 Education and Public Relations
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 02 Transportation

29 ENERGY PLANNING AND POLICY
- 10 Conservation
- 80 Consumption and Utilization
- 02 Economics and Sociology
- 60 Electric Power
- 01 Energy Analysis and Modeling
- 03 Environment, Health, and Safety
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 04 Natural Resources
- 06 Nuclear Energy
- 30 Policy, Legislation, and Regulation
- 05 Research, Development, Demonstration, and Commercialization
- 20 Supply, Demand, and Forecasting
- 07 Transport and Storage
- 90 Unconventional Sources and Power Generation
- 08 Waste Heat Utilization

25 ENERGY STORAGE
- 09 Batteries
- 04 Capacitor Banks
- 08 Chemical
- 02 Compressed Gas
- 05 Flywheels
- 07 Liquefied Gas
- 01 Magnetic
- 03 Pumped Hydro
- 06 Thermal

42 ENGINEERING
- 10 Combustion Systems
- 08 Electronic Circuits and Devices
- 02 Facilities and Equipment
- 04 Heat Transfer and Fluid Flow
- 03 Lasers
- 30 Marine Engineering
- 05 Materials Testing
- 40 Pollution Control Equipment
- 50 Power Cycles
- 20 Underground Engineering
- 09 Waste Processing Plants and Equipment

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 02 Assessment of Energy Technologies
- 01 Social and Economic Studies

45 EXPLOSIONS AND EXPLOSIVES
- 01 Chemical
- 03 Explosion Detection
- 02 Nuclear

70 FUSION ENERGY
- 02 Fusion Power Plant Technology
- 01 Plasma Research

99 GENERAL AND MISCELLANEOUS
- 05 Civilian Defense
- 03 Information Handling
- 04 Law
- 01 Management
- 02 Mathematics and Computers

58 GEOSCIENCES
- 04 Geochemistry
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 05 Oceanography

15 GEOTHERMAL ENERGY
- 07 By-Products
- 10 Direct Energy Utilization
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 02 Geology and Hydrology of Geothermal Systems
- 20 Geothermal Data and Theory
- 09 Geothermal Engineering
- 03 Geothermal Exploration and Exploration Technology
- 08 Geothermal Power Plants
- 04 Legal and Institutional Aspects
- 01 Resource Status and Assessment

57 HEALTH AND SAFETY

13 HYDRO ENERGY
- 05 Economics and Management
- 06 Environmental Aspects
- 03 Plant Design and Operation
- 07 Power-Conversion Systems
- 04 Regulations and Licensing
- 01 Resources and Availability
- 02 Site Geology and Meteorology

08 HYDROGEN
- 07 By-Products
- 09 Environmental Aspects
- 06 Industrial and Commercial Use
- 04 Marketing and Economics
- 01 Production
- 08 Properties
- 05 Safety
- 02 Storage
- 03 Transport

44 INSTRUMENTATION
- 03 Miscellaneous Instruments
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 01 Radiation Instrumentation
- 04 Well Logging Instrumentation

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 04 Economics
- 03 Isotopic Power Supplies
- 01 Physical Isotope Separation
- 02 Radiation Sources

36 MATERIALS
- 02 Ceramics, Cermets, and Refractories
- 01 Metals and Alloys
- 06 Other Materials

03 NATURAL GAS
- 09 Artificial Stimulation
- 40 Combustion
- 03 Drilling, Production, and Processing
- 08 Environmental Aspects
- 02 Geology and Exploration
- 05 Health and Safety
- 10 Legislation and Regulation
- 06 Marketing and Economics
- 04 Products and By-Products
- 30 Properties
- 01 Reserves
- 50 Storage
- 20 Transport, Pipelines, and Handling
- 07 Waste Management

05 NUCLEAR FUELS
- 30 Environmental Aspects
- 04 Feed Processing
- 07 Fuels Production and Properties
- 40 Health and Safety
- 60 Legislation and Regulations
- 10 Marketing, Economics, and By-Products
- 01 Reserves, Exploration, and Mining
- 50 Safeguards, Inspection, and Accountability
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 05 Uranium Enrichment
- 20 Waste Management

21 NUCLEAR POWER PLANTS
- 08 Economics
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 05 Power Reactors, Breeding
- 03 Power Reactors, Nonbreeding, Graphite Moderated
- 01 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Nonbreeding, Light-Water Moderated, Non-boiling Water Cooled
- 04 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated
- 07 Regulation and Licensing

22 NUCLEAR REACTOR TECHNOLOGY
- 02 Components and Accessories
- 04 Control Systems
- 05 Environmental Aspects
- 03 Fuel Elements
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety
- 06 Research, Test, and Experimental Reactors
- 01 Theory and Calculation

04 OIL SHALES AND TAR SANDS
- 06 Direct Uses and By-Products
- 03 Drilling, Fracturing, and Mining
- 10 Environmental Aspects
- 07 Health and Safety
- 08 Marketing and Economics
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 20 Regulations
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 09 Waste Research and Management

09 OTHER SYNTHETIC AND NATURAL FUELS
- 02 Alcohol Fuels
- 06 Gaseous Waste Fuels
- 01 Hydrocarbon Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 05 Liquid Waste Fuels
- 04 Solid Waste and Wood Fuels

43 PARTICLE ACCELERATORS
- 03 Auxiliaries and Components
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 01 Design, Development, and Operation
- 04 Storage Rings

02 PETROLEUM
- 50 Combustion
- 03 Drilling and Production
- 09 Environmental Aspects
- 02 Geology and Exploration
- 06 Health and Safety
- 10 Legislation and Regulation
- 07 Marketing and Economics
- 04 Processing
- 05 Products and By-Products
- 30 Properties
- 01 Reserves
- 40 Storage
- 20 Transport, Pipelines, and Handling
- 08 Waste Management

64 PHYSICS I
- 01 Astrophysics and Cosmology
- 02 Atmospheric Physics
- 03 Atomic, Molecular, and Chemical Physics
- 04 Fluid Physics
- 50 High Energy Physics

65 PHYSICS II
- 60 Condensed Matter Physics
- 50 Medical Physics
- 10 Nuclear Physics
- 12-20 Nuclear Properties and Reactions
- 30 Nuclear Theory
- 40 Radiation and Shielding Physics
- 61 Superconductivity
- 70 Theoretical and Mathematical Physics

14 SOLAR ENERGY
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 20 Heat Storage
- 08 Ocean Energy Systems
- 06 Photovoltaic Power Systems
- 01 Resources and Availability
- 10 Solar Collectors and Concentrators
- 05 Solar Energy Conversion
- 07 Solar Thermal Power Systems
- 09 Solar Thermal Utilization

16 TIDAL AND WAVE POWER
- 04 Economics
- 05 Environmental Aspects
- 03 Regulations
- 07 Tidal Power Plants
- 08 Wave Energy Converters

17 WIND ENERGY
- 01 Availability (Climatology)
- 04 Economics
- 05 Environmental Aspects
- 03 Regulations
- 06 Wind Energy Engineering

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

ORDER NUMBER CORRELATION

ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

48022 (ORNL/FMP—88/1) AR&TD fossil energy materials program semiannual progress report for the period ending March 31, 1988. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 560p. NTIS, PC A23/MF A01; 1; GPO Dep. Order Number DE88015372/JAW.

The objective of the AR&TD Fossil Energy Materials Program is to conduct research and development on materials for fossil energy application with a focus on the longer-term and generic needs of the various fossil fuel technologies. The program includes research aimed toward a better understanding of materials behavior in fossil energy environments and the development of new materials capable of substantial enhancement of plant operations and reliability. The management of the program has been decentralized to the DOE Oak Ridge Operations Office and the Oak Ridge National Laboratory. The ORNL Fossil Energy Materials Program Office compiles and issues this combined semiannual progress report from camera-ready copies submitted by each of the participating subcontractor organizations. This report of activities on the program is organized in accordance with a work breakdown structure in which projects are organized according to materials research thrust areas. It is hoped that this series of AR&TD Fossil Energy Materials Program semiannual progress reports will aid in the dissemination of information developed on the program.

0103 Preparation

REFER ALSO TO CITATION(S) 48063, 48064, 48109, 48492

48023 (CRL—87-79(TR)) Pilot-scale study on Batac jig washing of Bryan Mountain coal - Crow's Nest Resources (Job No. 24370). Mikhail, M.W.; Parsons, I.S.; Humeniuk, O.E. (Canada Centre for Mineral and Energy Technology, Sydney, Nova Scotia. Cape Breton Coal Research Lab.). Aug 1987. 48p. Canada Centre for Mineral and Energy Technology, Sydney, Nova Scotia. Cape Brenton Coal Research Lab.

The Batac jig is currently used in Germany's newer plants for washing both coarse and fine coal fractions. This project was undertaken to determine the suitability of the process for washing Canadian coals. A pilot plant scale Batac jig was installed at the Coal Research Laboratory, and coal samples for testing were obtained from Bryan Mountain. The objectives were to produce a clean coal with a minimum of 26271 kJ/kg heat value, and outline a flow sheet to achieve it. Based on coal characteristics and pilot plant testing, a flow sheet is proposed to gravimetrically clean the 200 X 12.7 X 0.6 and 0.6 X 0.15 mm size fractions in heavy medium bath, Batac jig, and water-only-cyclone respectively. 5 refs., 17 figs., 17 tabs.

48024 (CRL—87-83(TR)) Pilot-scale study on Batac jig washing of Kipp mine coal - Petro-Canada. Mikhail, M.W.; Parsons, I.S.; Humeniuk, O.E. (Canada Centre for Mineral and Energy Technology, Sydney, Nova Scotia. Cape Breton Coal Research Lab.). Aug 1987. 54p. Canada Centre for Mineral and Energy Technology, Sydney, Nova Scotia. Cape Brenton Coal Research Lab.

This project was undertaken to determine the suitability of the Batac jig for washing Canadian coals. A pilot plant scale Batac jib was installed at the Coal Research Laboratory, and Petro-Canada supplied coal samples from the Kipp mine for testing. The objectives were to produce a clean coal with a minimum of 24,423 kJ/kg heat value and to outline a flow sheet to achieve it or a higher heat value up to 27,400 kJ/kg (12% ash). Based on coal characteristics and pilot plant testing, a flow sheet is proposed to gravimetrically clean the 100 X 12.7, 12.7 X 0.5, and 0.5 X 0.15 mm size fractions in heavy medium bath, Batac jig and water-only-cyclone respectively. 4 refs., 21 tabs., 18 figs.

48025 (DOE/FC/10617—2592) Thermal dewatering of coal: Final report. Suuberg, E.M.; Deevi, S.C. (Brown Univ., Providence, RI (USA). Div. of Engineering). Feb 1988. Contract AC21-84FC10617. 187p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88001099/JAW.

This report presents the results of a comprehensive study on the changes in the physical and chemical structures of North Dakota lignites, occurring during low temperature (T < 110{degree}C) and mild pyrolytic (110{degree}C < T < 425{degree}C) drying. Some results for high temperature, high heating rate, short residence time pyrolysis are also given. Irreversible changes occur in the lignites' pore structures even when drying these materials at room temperature and at moderate relative humidities (75%). Time required for drying of these lignites is a strong function of particle size and temperature. The sorptive capacity of the lignites drops with increases in temperature in the 50 to 60{degree}C range; below this range, the moisture content of the lignite is only a function of ambient relative humidity. Demineralization of the lignites appears to have only a modest effect on moisture sorptive capacity. The crosslink density of the macromolecular structure of the lignites was measured by solvent swelling techniques.

48026 (DOE/PC/63048—T2) Liquid CO_2 coalescence of fine coal: Final report, October 1983-January 1988. Morsi, B.I.; Wong, Anni; Klinzing, G.E.; He, Daxin; Chiang, Shiao-Hung; Araujo, G.; Richardson, A.; Chi, S.M. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Feb 1988. Contract AC22-83PC63048. 86p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88009877/JAW.

A new method for fine coal cleaning, the LICADO process, is being investigated. This novel coal beneficiation technique uses liquid CO_2 for the separation of clean coal from mineral matter. The LICADO process is a surface-property driven process in which a coal-water slurry is placed in contact with liquid CO_2 at room temperature and approximately 850 psig. Due to their different surface properties, clean coal particles and mineral particles are separated into two streams. Clean coal is separated in the form of a coal-liquid CO_2 slurry while the mineral matter remains in the aqueous phase. This investigation covers the LICADO equipment and process development as well as the study of the coal cleaning mechanism. 42 refs., 33 figs., 15 tabs.

48027 (DOE/PC/79922—T4) Cyclone performance and optimization: Third quarterly progress report. Leith, D. (North Carolina Univ., Chapel Hill (USA). Dept. of Environmental Sciences and Engineering). 15 Jun 1988. Contract FG22-87PC79922. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015034/JAW.

During the third quarter of our first project year, we made substantial progress in several areas. First, we learned that the paper included with the last quarterly progress report, "Effect of cyclone dimensions on gas flow pattern and collection efficiency", has been accepted for publication to the journal Aerosol Science and Technology. Second, we have continued the work on modeling the efficiency curve. This work has led to preparation of a manuscript, "Logistic Equation and Cyclone Fractional Efficiency", that is ready for submission for publication, and is included with this report. We plan submission to Aerosol Science and Tech-

nology, as a followup to our previous paper. In general, the work is proceeding at a more rapid pace than originally envisioned. No major problems have developed with the equipment, experimental method, data analysis, or in any other area.

48028 **(DOE/PC/81209—T1) The use of a phase inversion/heavy-liquid cyclone system for fine coal beneficiation: Final report.** (Norton, Hambleton Engineering, Inc., Ann Arbor, MI (USA); Process Technology, Inc., Calumet, MI (USA)). 22 Dec 1987. Contract AC22-86PC81209. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88007304/JAW.

The objective of this project is the development of a coal preparation technology that can be used to reduce the ash and sulfur contents of US coals so that the product can be used either directly as a clean coal or formulated into a high quality fuel that could replace oil and/or natural gas and reduce environmental emissions in both new and retrofit applications. Specific goals of this program were understood to include production of a clean coal having an ash content in the range of 4% and an SO_2 emission potential as low as is economically possible to achieve. The research performed under this grant was carried out in a two-stage Phase Inversion/Heavy-Liquid Cyclone process on coal samples from three major US coal seams. The coal samples were each ground to three different progressively finer size distributions ranging from a 20 mesh to 325-mesh topsize. The Heavy-Liquid Cyclone (HLC) stage of this process employs organic liquids in a unit operation already widely employed in the coal industry. The Phase Inversion stage has been under development at Dow Chemical on a bench scale and has shown promising results prior to this test work as an independent beneficiation technique. In the current scheme, the Phase Inversion process was used as a front end to the Heavy-Liquid Cyclone process in an effort to remove fine ash and clay particles which interfere with the efficiency of the cyclone. The Phase Inversion device also acts to remove water from the coal cleaning process allowing a coal/water slurry to be introduced as feed to the circuit, and a water-free intermediate product to be fed to the cyclone downstream. This process met the requirements laid out in the Program Research & Development Announcement by producing clean coal products as low as 2.55% ash and 0.92% sulfur from several raw coal feeds that ranged from 8 to 12% ash and 2 to 4% sulfur and encompassed three (3) major coal seams. 5 figs., 24 tabs.

48029 **(ERP/CRL—87-78(TR)) Pilot plant scale evaluation of beneficiation potential of Donkin-Morien coal, N.S.** Mikhail, M.W.; Humeniuk, O.E.; Salama, A.I.A.; Parsons, I.S. (Canada Centre for Mineral and Energy Technology, Devon, Alberta. Coal Research Lab.). Aug 1987. 140p. Canada Center for Mineral and Energy Technology, Devon, Alberta. Coal Research Lab.

Donkin-Morien coal was selected for testing as part of a program for evaluation of the beneficiation potential of eastern Canadian coals. A bulk sample (74t) was made available for testing at a pilot plant scale operation at the Coal Research Laboratory. Objectives of the study included: determination of coal characteristics affecting beneficiation, and determination of the potential of reducing sulfur content in relation to mass and thermal recoveries. Results from tests using Batac jig, heavy medium cyclone, and water-only tricone cyclones, are discussed. The heavy medium cyclone system provided the best results. Pilot plant results are used to predict parameters such as liberation, amount of fines to be treated and expected sulfur reduction in relation to possible commercial scale up. 10 refs., 43 tabs., 30 figs.

48030 **(EUR—11109-EN) Nucleonic methods for the measurement of coal and ash.** Wykes, J.S.; Gibson, M.J.; Adsley, I.; Croke, G.M.; Hoddy, J.D. (Commission of the European Communities, Luxembourg). 1987. 160p. (In English). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

The continuing development of nucleonic instruments for monitoring material on conveyor belts has resulted in a much greater understanding of the principles behind their operation and of their limitations. A natural gamma stone detector has been evaluated in the laboratory and is now certified for underground use. The combination of this instrument with some form of mass measurement to provide a simple coal quality monitor has been shown to be practicable and initial surface trials of an experimental system have produced encouraging results. Theoretical and laboratory work have demonstrated the feasibility of a dual gamma beam transmission system (the BCS1) for measuring the stone/ash content of coal/stone loads with reasonable accuracy. Initial surface trials of an experimental BCS1 have been conducted but the analysis of results has not yet been completed. Limited colliery surface trials have demonstrated the performance of the stone detector under suitable conditions. Similar trials of experimental coal quality monitors and an experimental BCS1 are being arranged. All colliery trials work was severely affected by the 1984/85 industrial dispute. There has been some consideration of a dual X-ray transmission coal/stone monitor but further work has been held in abeyance pending the assessment of gamma based methods. Work on the neutron capture/prompt gamma technique for multi-element analysis, including the development of appropriate data processing, has shown that adequate accuracy should be possible in a reasonable measurement time with recent developments in nuclear electronics.

0104 Processing

REFER ALSO TO CITATION(S) 48063, 48064, 48078, 48079, 48107, 48107, 48166, 48501, 48696, 49110

48031 **(DOE/ER/13616—2) [Free radical and rearrangement reactions in coal liquefaction: Progress report].** (Indiana Univ., Bloomington (USA)). [1988]. Contract FG02-86ER13616. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014668/JAW.

Experimental efforts have focused on the high temperature reactions of tetralin. Previous work with phenyl tetralins in tetralin solvent resulted in rearrangement not unlike those of tetralin itself. Further, there is some controversy over the pathways involved in tetralin pyrolysis. We therefore began to examine the pressure dependence of the thermally induced reaction. The past year witnessed continued development of a molecular mechanics program derived from MM2 and the pi calculation subroutines of MMPI. The heats of formation of radicals are being reproduced to +/{minus} 2 kcal/mol. In addition, more transition state parameters have in introduced to reproduce the steric effects observed in 5-hexenyl radical cyclizations. Investigations of transition metal complexes using molecular mechanics have focused on complexes of chromium, copper, iron, nickel, cobalt and molybdenum. We have been comparing the geometries calculated by MM with the X-ray crystal structures reported in the Cambridge crystallographic database.

48032 **(DOE/MC/21050—2595) ASPEN simulation of environmental control processes: Final report.** Noblett, J.G. Jr.; Lowell, P.S.; Wilde, K.A.; Dweck, J.S. (Lowell (P.S.) and Co., Inc., Austin, TX (USA); Dweck (J.S.), Consultant, Inc., Denver, CO (USA)). Apr 1988. Contract AC21-84MC21050. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88010251/JAW.

The United States Department of Energy (DOE) at the Morgantown Energy Technology Center (METC) contracted with P.S. Lowell and Co. Inc. (Lowell and Co.) and Jay S. Dweck, Consultant, Inc., (JSD) to enhance the capability of ASPEN in simulating coal gasification and oil shale processing plants. Of particular concern was the capability to predict the distribution of environmentally significant components among the various aqueous and organic liquids and gas streams within or leaving the process. The project was divided into major task areas. The first was to develop and implement the calculational routines necessary for predicting aqueous electrolyte chemical reactions. Part of this effort also was to select a species list and collect and/or regress data for the necessary parameters. The second task was to develop and implement a multi-phase flash capability (including precipitated solids) and unit operations models for a venturi and a solid/liquid separator. 19 refs., 3 figs.

48033 **(DOE/METC—88/6092-Vol.1) Proceedings of the eight annual gasification and gas stream cleanup systems contractors review meeting: Volume 1.** Kothari, V.P.; Longanbach, J.R.(eds.). (USDOE Morgantown Energy Technology Center, WV). May 1988. 424p. (CONF-880544—). NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE88010253/JAW.

From 8. annual gasification and gas stream cleanup systems; Morgantown, WV, USA (10 May 1988).

Forty-three papers and 31 poster displays were presented summarizing recent developments in the gasification and gas stream cleanup programs at the contractors review meeting. This volume covers sessions one and two on systems for the production of power and systems for the production of industrial fuel gas. Individual projects of those sessions are processed separately for the data bases.

48034 **(DOE/OR/00033—T410) The design and fabrication of a total organic carbon analyzer.** Miller, J.A. (State Univ. of New York, Oswego (USA). Research Center). 1987. Contract AC05-76OR00033. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88015643/JAW.

An automated total organic carbon (TOC) analyzer has been constructed to analyze highly contaminated wastewaters from coal gasification and liquefaction processes. These wastewaters have TOC contents of 10--20,000 mg/L, sulfide contents of 20--30,000 mg/L and ammonia contents of 1000--20,000 mg/L. Most commercial TOC analyzers require dilution of such wastewaters and/or traps and scrubbers to remove the oxides of sulfur and nitrogen that interfere with the measurement of carbon dioxide. This TOC analyzer was designed to handle these wastewaters with a minimum of sample preparation, with no traps or scrubbers and with a minimum of operator attention. The TOC analyzer uses a high temperature cobalt oxide on asbestos packed reactor for total carbon (TC) determinations and a low temperature phosphoric acid wetted quartz chip packed reactor for carbonate carbon (CC) determinations, with TOC being the difference (TOC = TC--CC). The furnace temperatures are regulated by time-proportioning temperature controllers. A mass/flow controller is used to regulate the oxygen carrier/combustion gas flow rate. The carbon dioxide produced is measured by a nondispersive single-beam infrared photometer. A commercially available laboratory automation system operates and monitors the TOC analyzer. The automation system operates the analyzer via two event control modules (ECM's). Generally 20 μL injection volumes are used and samples having carbon concentrations of 10--10,000 mg/L can be analyzed every three minutes. The signal from the infrared photometer is digitized by an analog-to-digital converter and stored by the automation system. The automation system monitors the oxygen flow rate and the TOC analyzer's power status. If a problem develops, the automation system shuts down the analyzer and notifies the operator. 30 refs., 9 figs., 11 tabs.

48035 **(DOE/PC/60044—T8) New and improved dispersion and recovery techniques for slurry phase catalysis: Final technical report.** Tarrer, A.R.; Guin, J.A.; Tatarchuk, B.J.; Curtis, C.W. (Auburn Univ., AL (USA). Dept. of Chemical Engineering). Jan 1988. Contract AC22-83PC60044. 254p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88006545/JAW.

This is the final report covering catalysts of coal liquefaction. It covers the entire duration of the project---from September 22, 1983 through December 21, 1986. This report delineates the following aspects of our research. Hydrodenitrogenation of quinoline and coal using precipitated transition metal sulfides. Inhibition of catalytic naphthalene hydrogenation by model heteroatomic and multi-ring aromatic coal liquid compounds. Hydrogenation and hydrodesulfurization over sulfided ruthenium catalysts containing partial monolayers of adsorbed sulfur. Impact of surface phase behavior on activity and selectivity of sulfided ruthenium catalysts during hydrogenation and hydrodesulfurization. The preparation of the transition metal catalysts and catalyst supports is discussed. Conclusions of the catalytic effects are presented. 23 refs., 4 figs., 37 tabs.

48036 **(DOE/PC/79652—T1) L-star pulsed coal combustor for residential space heating: Quarterly progress report, October 1987-January 1988.** (Avco-Everett Research Lab., Everett, MA (USA)). Mar 1988. Contract AC22-87PC79652. 49p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013088/JAW.

The initial design work for a 100,000 Btu/hr coal fired L-star combustor is complete. Requirements for system performance have been analyzed via a mathematical model, and two promary combustor configurations have been identified for initial testing. Component and subsystem testing was initiated early in the program and is largely complete. Data have been gathered for the coal, natural gas (for combustion assist in the early experimental stage, and air injection systems). A prototype combustor has been assembled and outfitted with diagnostic instrumentation. A laboratory has been configured to support the combustion experiments. The system layout for this effort is shown in Figure. 27 figs.

48037 **(DOE/PC/79930—T4) Pyrolysis and gasification of coal at high temperatures: Quarterly progress report, 3/15/88-6/15/88.** Zygourakis, K. (Rice Univ., Houston, TX (USA). Dept. of Chemical Engineering). 1988. Contract FG22-87PC79930. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015035/JAW.

The effects of pyrolysis heating rate on the micropore structure of chars produced from a non-plastic lignite coal were investigated. Coal particles in the 50--60 mesh size fraction were pyrolyzed in our captive-sample reactor at 0.1, 10 and 1000{degree}C/s/. As before, we characterized the micropore structure of the three chars by analyzing digitized particle cross-sections. This analysis revealed that the large macropores of the lignite chars are mostly elongated "cracks" or fissures. Thus, the micropore structure of lignite chars is different than that of chars produced from the plastic Illinois No. 6 coal. The stereological measurements revealed small effects of the pyrolysis heating rate both on the porosity and on the specific micropore surface areas. Several simulations were carried out to investigate the gasification behavior of the three lignite chars. The predicted gasification rate vs. conversion patterns did not exhibit a maximum, as was the case with the Illinois No. 6 chars. 9 figs.

48038 **(DOE/PC/80023—T14) The effect of aliphatic hydrocarbon on the hydrogen solubility and the hydrogen mass transfer rate on coal liquid solvents.** Liaw, Shuh-Jeng. (Pittsburgh Univ., PA (USA)). [1988]. Contract AC22-85PC80023. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015247/JAW.

The purpose of this Ph.D. research proposal is to understand : (1) The effect of methane or ethane on the hydrogen solubility in tetralin, (2) The effect of methane or ethane on the hydrogen mass transfer rate in tetralin, (3) The rate and quantification of dehydrogenation of donor solvent liquids. Because nickel tube will lose its integrity and become brittle in the presence of hydrogen sulfide, a 36 stainless steel will also be used instead of nickel tube. Thus it is necessary to investigate the permeability of hydrogen to this type of stainless steel. Coal liquefaction with a hydrogen donor solvent yields low molecular weight substances. The knowledge of the effects of methane and ethane, the first and second most prevalent aliphatic carbons, on hydrogen solubility and mass transfer rate can be important to design consideration of coal liquefaction. Tests which were carried out using Lummus liquid and tetralin show that a certain amount of hydrogen is liberated from these liquids. The amount of hydrogen that is liberated from tetralin is compared with that of Lummus liquid which appears to liberate more hydrogen. The next step will be concentrated on the effect of the hydrogen concentration of the atmosphere above the reactor on the rate of dehydrogenation of the donor solvent liquids and determine the donor quality of different process solvents. 43 refs., 17 figs., 1 tab.

48039 **(DOE/PC/80502—T10) Interactive chemistry of coal-petroleum processing: Quarterly report, March 16, 1988 to June 15, 1988.** Curtis, C.W.; Guin, J.A.; Tarrer, A.R. (Auburn Univ., AL (USA). Dept. of Chemical Engineering). 1988. Contract FG22-85PC80502. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88014537/JAW.

The reaction pathways for hydrogenating the model systems composed of aromatics, cyclic hydrocarbons and heteroatomics representative of coal and petroleum residuum with in situ sulfided molybdenum naphthenate have been elucidated. The in situ generated molybdenum sulfide was selectively active for partial saturation of aromatic rings compared to $NiMo/Al_2O_3$ which was active for fully saturating the aromatic rings. In heteroatomic compound hydrogenation, two different reaction pathways were proposed simultaneously to produce the different products: one for heteroatom removal without adjacent aromatic ring saturation to obtain alkyl aromatics and one for heteroatom removal from the saturated adjacent ring to obtain alklycyclic hydrocarbons as products. In situ sulfided molybdenum naphthenate was severely poisoned by the organic nitrogen compounds but not affected by the sulfur compounds. 16 refs.

48040 **(DOE/PC/80518—T11) Surface chemistry of model Co-Mo catalysts supported on planar γ-Al_2O_3: Quarterly technical progress report, March 1, 1988-May 31, 1988.** Sahin, T.; Ford, W.K. (Montana State Univ., Bozeman (USA)). 1988. Contract FG22-85PC80518. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013008/JAW.

This quarter, we have done some TPD work on our planar model catalysts and a planar aluminum oxide support. Benzene showed a single desorption peak at 373 K on a planar alumina support. However, when benzene was adsorbed on calcined planar model catalyst, there was a broad unresolved peak starting around 450 K and leveling off around 680 K. Benzene appears to decompose on the calcined catalyst as indicated by a single weak desorption peak at 380 K. The high temperature peak was very small or absent depending on the surface coverage of the previous TPD run. In collaboration with Prof. J.M. White at the University of Texas at Austin, we have started work on planar model catalysts grown on single crystal Al(110) surfaces. In this study our objective is to investigate the effects of preferred crystal orientation on the catalytic properties. In Ford's lab, the new laser has been installed and made operational for second harmonic surface studies. Oxygen adsorption on Al(lll) has been studied using kelvin probe and second harmonic generation. As was mentioned in the last quarter's report, Wade Brown (graduate student) is writing his master's thesis. The future work for the next quarter includes the continuation of the adsorption studies and oxidation characteristics of the (lll) aluminum.

48041 **(DOE/PC/80906—9) Catalytic methods for improved coal liquefaction and hydrotreating: Final report, September 22, 1985-December 31, 1987.** Hirschon, A.S.; Laine, R.M.; Wilson, R.B. Jr.; Ackerman, L.L. (SRI International, Menlo Park, CA (USA)). Mar 1988. Contract FG22-85PC80906. 177p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88007555/JAW.

This report summarizes our research. The goal was to develop improved catalysts and reaction conditions for coal liquefaction and upgrading coal liquids under low severity conditions. Research was divided into the following: Synthesis of Catalysts predicted to be highly active and selective toward hydrogenolysis reactions; Hydrogenolysis Activity of Catalysts with Model Systems. We compared catalysts HDN reactivities by reaction with quinoline and observing rates of C-N bond cleavage and the product distribution of propylbenzene and propylcyclohexane. Of the surface-confined catalysts synthesized from molybdenum allyl clusters, the NiMo catalyst had as much as 30% higher activity than a conventional catalyst. When the catalyst was promoted with ruthenium the rate increased still further, and was still sulfur tolerant. We studied the effects of nucleophiles and acids to the HDN of coal liquids, was well as the effect of the CoMo and RuCoMo catalyst on coal liquefaction and coal liquid upgrading. We also compared the effects of CoMo and RuCoMo on the liquefaction of a Wyodak coal in the presence of tetralin and hydrogen, RuCoMo was tested as an HDN catalyst on an SRC-II coal liquid. 15 refs., 5 figs., 5 tabs.

48042 **(DOE/PC/90909—T7) Low severity coal liquefaction using homogeneous basic nitrogen catalysts: Technical progress report, February--April 1988.** Miller, R.L.; Baldwin, R.M. (Colorado School of Mines, Golden (USA). Dept. of Chemical Engineering and Petroleum Refining). 1988. Contract FG22-86PC90909. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014854/JAW.

During the seventh quarter of this project, work continued on measuring the extent of nitrogen incorporation during low severity liquefaction or co-processing. Batch reactor experiments were carried out to evaluate the effectiveness of seven model nitrogen compounds in promoting coal conversion and distillate production at low severity reaction conditions. Addition of dipropylamine and 1,2,3,4-tetrahydroquinoline to Cold Lake atmospheric residuum improved Kentucky 9 coal conversion by 53 wt % and 41 wt %, respectively, with minimal nitrogen incorporation or thermal degradation losses. Reaction severity was found to strongly influence distillate yield and nitrogen incorporation, but impacted coal conversion to a much lesser extent. This observation suggests the use of a low severity coal dissolution step promoted by nitrogen compound addition followed by a catalytic upgrading step to maximize distillate yield. 27 refs., 4 figs., 5 tabs.

48043 **(EUR—11121-DE) The thermal technology of coke ovens II - theoretical studies and practical experiments relating to the development of a mathematical model of the coking process.** Suessmeier, T.; Huhn, F.; Eisenhut, W. (Commission of the European Communities, Luxembourg). 1987. 142p. (In German). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

A mathematical model describing the temperature fields during the heating-up of coke and coal charges was developed taking account of material transport procedures. It was checked by means of experiments carried out in a test reactor and found to be sufficiently accurate. First of all coal charges which were either dry or enriched with specific amounts of water were heated. In this way information was obtained on the flow path of the water vapour released. In particular it was noted that the entire charge soon reached a temperature of 100/sup o/ C, as a result of the recondensing of the water vapour. The mathematical modelling of these evaporation and condensation processes took the form of a partial model. As far as water vapour is concerned, observations were similar when various Ruhr coals were coked, and it was possible to prepare a mathematical description in a similar way. In addition, a partial model taking account of the material transport of volatile matter had to be prepared. The temperature fields measured at one level during the heating of coke and the coking of various coals were satisfactorily reproduced by the unidimensional mathematical model based on the extended Fourier equation. This unidimensional model describing heat and material transport was then extended to form a simplified two-dimensional model. It was shown that the two-dimensional temperature fields measured in the charge can be reproduced with a sufficient degree of accuracy by stacking unidimensional models. Corrections are necessary only at the top and bottom of the charge, to take account of the edge effect.

48044 **(NP—8770303) Catalytic hydrogenation of heavy residual oils from mineral oil processing and mixtures of residual oils and brown coal (co-processing) in the liquid phase to gasoline and diesel oil. Final report.** Giehr, A.; Lenz, U.; Wawrzinek, J. (Rheinische Braunkohlenwerke A.G., Koeln (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Mar 1986. 54p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88770303/JAW.

Within the scope of this project, investigations on the liquid-phase hydrogenation of heavy residual oils and mixtures of residual oils and dried brown coal were conducted in a process development unit. The object was to: clarify the action of liquid-phase catalysts and develop efficient catalysts derived from grown coal

products; rotary hearth furnace coke has proved to be particularly suitable, determine the yield and product quality when various residual oils of different origins are used; depending on the residual oil used it was possible to obtain conversion rates of between 70 and 95%, demonstrate the technical feasibility of co-processing of mixtures of residual oils and brown coal; with an almost unchanged yield distribution part of the residual oil was replaced by brown coal, check treating of liquid-phase products in the gas phase under refining conditions; this investigation showed that liquid-phase products called for stricter specifications than comparable straight-run products. (orig.) With 1 tab., 17 figs.

48045 **(NP—8770362) Low temperature carbonization of residues in the rotary drum. Final report.** Wenning, H.P. (VEBA-Oel A.G., Gelsenkirchen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1987. 76p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770362/JAW.

The objective of the project was the planning, construction and operation of a pilot plant for the continuous low temperature carbonization of liquid residues from the heavy oil and coal hydrogenation in an indirectly heated rotary drum. The process concept is based on the experience made during the 2nd World War with the 'rotary kilns' used in Germany for low temperature carbonization of coal hydrogenation residues. In the pilot plant operation it was possible to eliminate the disadvantages of the former rotary kilns - extremely high abrasion due to cross devices installed for the removal of caking and low specific throughput. Besides the pilot plant runs served to determine essential data for the design of a commercial plant. The feed used during a total operating time of 3,250 h amounted to 510 tonnes of crude oil residues, heavy oil hydrogenation residues, pyrolysis oil from hydrogenation residues and coal tar. (orig.) With 6 tabs., 17 figs.

48046 **(NP—8770378) Development of a coal gasification process in the circulation fluid bed under elevated pressure. Final report.** Rudisch, R.; Reimert, R.; Mehrling, P.; Zapke, K. (Lurgi G.m.b.H., Frankfurt am Main (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). May 1986. 60p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88770378/JAW.

The process principle of the Circulating Fluid Bed (CFB) has proven many advantages in alumina calcination and coal combustion. Therefore, it was intended to apply the CFB also for coal gasification. As a first step, gasification in a CFB reactor was to be demonstrated. In a following step, a complete gasification plant was to be designed. Emphasis was to be put on some critical process and equipment items. In an already existing pilot plant (1 bar) for coal combustion the gasification test runs were carried out. These tests proved that the particular, inherent features of the CFB principle apply advantageously also to gasification. It was possible to gasify a caking subbituminous coal as well as a low reactive petrol coke with high conversion ratios and no operational problems. Both feedstocks are difficult to gasify when applying common fluidized bed gasification technology. The basic and partly detailed engineering work spent on the process and equipment resulted in a complete design for a gasification plant. According to the available knowledge, such a plant can be built and operated without major risks. Depending on the gasification agent (oxygen or air), the gasification plant may produce a synthesis gas or a fuel gas. (orig.) With 5 figs., 10 tabs.

48047 **(PB—88-207998/XAB) Cool Water Coal Gasification Program: environmental monitoring plan. Quarterly report, January 1-March 31, 1986.** (Cool Water Coal Gasification Program, Daggett, CA (USA)). 18 Jun 1986. 101p. NTIS, PC A06/MF A01.

Also pub. as Radian Corp., Austin, TX. rept. no. DCN-86-218-042-17. See also PB—88-143912.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Cool Water Coal Gasification Program is one of the four projects awarded financial assistance. As the first commercial-scale integrated gasification combined-cycle plant for generating energy from coal, the plant is designed to process a variety of coals with no liquid discharge, produce non-hazardous solid wastes, and produce very few air emissions. Monitoring data are to provide an information base for evaluating plant operations and for establiahing information on environmental uncertainties associated with replication of synthetic-fuels facilities. This eport summarizes progress in environmental sampling and analysis during the quarter and ambient-air monitoring data from the previous quarter.

48048 **(PB—88-208004/XAB) Cool Water Coal Gasification Program: environmental monitoring plan. Quarterly report, April 1-June 30, 1986.** (Cool Water Coal Gasification Program, Daggett, CA (USA)). 29 Sep 1986. 143p. NTIS, PC A07/MF A01.

Also pub. as Radian Corp., Austin, TX. rept. no. DCN-86-218-042-36. See also PB—88-207998.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Cool Water Coal Gasification Program is one of the four projects awarded financial assistance. As the first commercial-scale integrated gasification combined-cycle plant for generating energy from coal, the plant is designed to process a variety of coals with no liquid discharge, produce non-hazardous solid wastes, and produce very few air emissions. Monitoring data are to provide an information base for evaluating plant operations and for establishing information on environmental uncertainties associated with replication of synthetic fuels facilities. The report summarizes environmental sampling and analysis completed during the quarter and presents ambient air monitoring data for the first quarter of 1986.

48049 **(PB—88-208012/XAB) Cool Water Coal Gasification Program: environmental monitoring plan. Quarterly report, October 1-December 31, 1986.** (Cool Water Coal Gasification Program, Daggett, CA (USA)). 8 Apr 1987. 74p. NTIS, PC A04/MF A01.

Also pub. as Radian Corp., Austin, TX. rept. no. DCN-87-218-042-66. See also PB—88-208004. Portions of this document are not fully legible.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Cool Water Coal Gasification Program is one of the four projects awarded financial assistance. As the first commercial-scale integrated gasification combined-cycle plant for generating energy from coal, the plant is designed to process a variety of coals with no liquid discharge, produce non-hazardous solid wastes, and produce very few air emissions. Monitoring data are to provide an information base for evaluating plant operations and for establishing information on environmental uncertainties associated with replication of synthetic fuels facilities. The report summarizes progress in sampling and analysis pursuant to the Environmental Monitoring Plan conducted during nearly 1440 hours of plant operation.

48050 **(PB—88-208020/XAB) Cool Water Coal Gasification Program: environmental monitoring plan - Monitoring Review Committee meeting report, November 6-7, 1986, Daggett, California.** (Cool Water Coal Gasification Program, Daggett, CA (USA)). Nov 1986. 251p. NTIS, PC A12/MF A01.

See also PB—88-143946.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Cool Water Coal Gasification Program is one of the four projects awarded financial assistance. As the first commercial-scale integrated gasification combined-cycle plant for generating energy from coal, the plant is designed to process a variety of coals with no liquid discharge, produce non-hazardous solid wastes, and produce very few air emissions. A Monitoring Review Committee (MRC) comprised of participants from DOE, EPA, and California Energy Commission, meets with the Program annually to discuss monitoring activities and review environmental and health-monitoring information to determine any significant trends or patterns on pollutant releases.

Results of the third annual MRC meeting held November 6 and 7, 1986 are presented.

48051 **(PB—88-208038/XAB) Cool Water Coal Gasification Program: environmental monitoring plan - Monitoring Review Committee meeting report, April 29, 1987, Washington, DC.** (Cool Water Coal Gasification Program, Daggett, CA (USA)). Apr 1987. 63p. NTIS, PC A04/MF A01.

See also PB—88-208020.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Cool Water Coal Gasification Program is one of the four projects awarded financial assistance. The Program agreed to comply with existing environmental monitoring regulations and to develop an Environmental Monitoring Plan incorporating supplemental monitoring in the areas of water, air, solid waste, worker health and safety, and socio-economic impacts during the period 1984-1989. The plant is designed to process a variety of coals with no liquid discharge, produce non-hazardous solid wastes, and produce very few air emissions. A Monitoring Review Committee (MRC) comprised of participants from DOE, EPA, and California Energy Commission, meets with the Program annually to discuss monitoring activities and review environmental and health monitoring information to determine any significant trends or patterns on pollutant releases. Results of the third annual of fourth annual MRC meeting held April 29, 1987 are presented.

48052 **(PB—88-208046/XAB) Cool Water Coal Gasification Program: environmental monitoring plan - Illinois No. 6 reduced screening phase, final report. Volumes 1 through 5. Appendices A through E. Technical report.** (Cool Water Coal Gasification Program, Daggett, CA (USA)). 10 Aug 1987. 680p. NTIS, PC A99/MF E04.

Also pub. as Radian Corp., Austin, TX. rept. no. DCN-87-218-042-76.

The Cool Water Coal Gasification Program began electrical production under a Price Guarantee Commitment with the U.S. Synthetic Fuels Corporation June 24, 1984. An Environmental Monitoring Plan (EMP) was approved under the Commitment and is now administered by the Dept. of Treasury. The EMP designates four phases of monitoring: Commissioning, Comprehensive, Indicator and Reduced Screening. Reduced Screening occurs during plant operations using coals other than SUFCO. This first reduced screening phase occurred during January, February and March, 1986, when Illinois No. 6 coal was gasified. Gaseous emissions and aqueous and solid samples were analyzed. Pollution control devices were tested. These results are discussed, as are Quality Assurance / Quality Control.

48053 **(PB—88-208053/XAB) Cool Water Coal Gasification Program: environmental monitoring plan - Pittsburgh No. 8 reduced screening phase, final report. Volumes 1 and 2, Appendices A-D.** (Cool Water Coal Gasification Program, Daggett, CA (USA)). 23 Oct 1987. 495p. NTIS, PC A21/MF A01.

Also pub. as Radian Corp., Austin, TX. rept. no. DCN-87-218-042-82. See also PB—88-208046.

The Cool Water Coal Gasification Program began electrical production under a Price Guarantee Commitment with the U.S. Synthetic Fuels Corporation June 24, 1984. An Environmental Monitoring Plan (EMP) was approved under the Commitment and is now administered by the Dept. of Treasury. The EMP designates four phases of monitoring: Commissioning, Comprehensive, Indicator and Reduced Screening. The second reduced screening phase occurred during May, 1986. Results of gaseous, aqueous and solid stream sampling are presented, as are ambient air monitoring and quality assurance/quality control efforts.

48054 **(PB—88-215777/XAB) Catalytic hydrogenation of high volatility bituminous coal and various coal extracts: final report for 1986-1987. SOMED (School of Mines and Energy Development) project. Faculty research report.** Kispert, L.D. (Alabama Univ., University (USA). School of Mines and Energy Development). Sep 1987. 24p. (RR—84). NTIS, PC A03/MF A01.

Model compounds, naphthalene, quinolines, and isoquinoline (possible extracts of coal) were selectively hydrogenated to 1,2,3,4-tetrahydro products by a Ziegler-type catalyst (I) made of cobalt stearate and triethyl aluminum (1:2 molar ratio) in hexane solvent and temperatures as low as 22°C and hydrogen pressure of 700-800 psi. It was established that a hydrogen pressure greater than 300 psi is crucial for hydrogenation to occur. The important feature of the Ziegler catalyst is that it works best at low temperatures, moderate pressures, and short reaction times, most unusual for a Ziegler catalyst. A sample of solvent-refined coal (SRC) (less than .9% sulfur) was previously liquefied at 90 degree C and hydrogen pressure of 800 psi in a period of 24 h. In this, a sample of Illinois No. 6 high-volatility bitiminous coal (a high-sulfur coal, 5.8% S) was treated with catalyst (I) under the same conditions as applied for SRC. Analysis indicated a 10% conversion for the high-sulfur coal.

48055 **(SAND—88-1045C) Computer-aided molecular design of alkane-activation catalysts.** Shelnutt, J.A.; Stohl, F.V.; Granoff, B. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 8p. (CONF-880912—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011543/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

Our work focuses on a novel biomimetic approach to the development of catalysts for activation of methane, using computer-aided molecular design (CAMD) techniques. The biomimetic CAMD methodology consists of several elements: (1) Design activities are guided by the structural and chemical information about naturally occurring biological catalysts that carry out alkane oxidation to alcohols. The macromolecular biological catalysts are investigated to determine the features that need to be designed into a synthetic catalyst in order to mimic the alkane-oxidation function. (2) Molecular mechanics calculations are used to evaluate possible designs for catalysts based on synthetic metalloporphyrins. The metalloporphyrins have been chosen because they occur at the active site of many monooxygenases and other enzymes that catalyze C_1 chemistry. Also, the porphyrin macrocycle provides a platform upon which additional molecular architecture is erected to provide the structural features required to mimic the enzymes. (3) The computer designed catalysts are then synthesized. (4) The synthetic catalysts are characterized by various spectroscopic techniques including Raman-difference, transient Raman, FTIR, NMR, and uv-visible absorption spectroscopies. (5) The designed catalysts are tested in alkane-oxidation reactions. The activity test results and results of the structural studies are evaluated to obtain structure-activity relationships that form a basis for making further improvements in the catalyst. This feedback procedure gives an iterative method for optimizing catalytic properties. 20 refs., 3 figs.

48056 **(SAND—88-1155C) Studies of deactivating species on coal liquefaction catalysts.** Stohl, F.V.; Malhotra, R. (Sandia National Labs., Albuquerque, NM (USA)). [1988]. Contract AC04-76DP00789. 11p. (CONF-880912—11). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88011781/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

Objectives of this catalyst deactivation work are to determine how the deactivation due to hydrotreating strongly basic nitrogen compounds occurs on the catalyst surface and to identify the compounds that cause the deactivation. The work is aimed at evaluating the usefulness of Field Ionization Mass Spectrometry (FIMS) analyses for our catalyst deactivation studies. Results of the application of FIMS techniques to characterize the compounds volatilized from the aged catalysts and the liquid products of our quinoline HDN experiments are described. Results are compared to those obtained for catalysts used at Wilsonville. The field emission method employed in FIMS is a mild, yet efficient, ionization that exclusively produces molecular ions from most chemical compounds. Thus the mass spectra of complex mixtures are not complicated by the presence of large numbers of peaks associated with molecular fragments. FIMS thus provides molecular profiles of samples. 11 refs., 4 figs., 1 tab.

48057 **(SAND—88-1160C) High liquid yields from bituminous coal via hydropyrolysis with dispersed catalysts.** Snape, C.E.; Bolton, C.; Dosch, R.G.; Stephens, H.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-880912—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011490/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

We report the results of catalytic hydropyrolysis experiments in which greater than 60% daf coal basis yields of tar are produced with weight ratios of tar to gases up to 80% higher than observed in an uncatalyzed reaction. The work has also shown that dispersed sulfided molybdenum and hydrous titanium oxide (HTO) catalysts coated directly on the coal are superior to Lewis acids and alumina supported hydrogenation catalysts in terms of tar yields achieved and reduction of the amount of light hydrocarbon gases produced. In addition, we have performed two-stage hydropyrolysis tests which demonstrate that the tar produced is readily upgraded. 15 refs., 2 tabs.

48058 **(UCRL—98641) Execution and performance of the CRIP process during the Rocky Mountain 1 UCG field test.** Thorsness, C.B.; Hill, R.W.; Britten, J.A. (Lawrence Livermore National Lab., CA (USA)). 1 Aug 1988. Contract W-7405-ENG-48. 8p. (CONF-880874—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015440/JAW.

From 14. annual underground coal gasification symposium; Schaumburg, IL, USA (15 Aug 1988).

The Controlled Retracting Injection Point (CRIP) process for underground coal gasification (UCG) was successfully demonstrated during the Rocky Mountain I (RM I) field test conducted in the winter of 1987-88 near Hanna, Wyoming. The basic features for the CRIP process are its ability to maintain oxidant injection low in the coal seam by utilizing a horizontal, lined injection borehole, and its ability to re-ignite the coal at a given location via a movable igniter/torch assembly, when heat losses to inert overburden begin to degrade product gas quality in the mature cavity. This assembly is positioned to burn through the stainless steel liner at desire locations, creating new injection points for oxygen and steam, thereby allowing for multiple cavities from a single injection borehole. During the field test, thermocouples in the vicinity of the reactors indicated growth of the cavity beginning low in the coal seam. Also, on each of the three occasions that the torch was used to cut the liner and initiate a new cavity, a rapid improvement in gas quality occurred. These results confirm the ability of the CRIP process to operate as planned. In this paper the details of the igniter assembly are described, operating conditions during the liner cutting maneuvers are presented and data describing the system response to the initiation of new cavities are analyzed. Finally, optimization of the igniter assembly and its use at high pressures and in alternate geometries is discussed. 9 refs., 12 figs.

48059 **(UCRL—98642) The Rocky Mountain 1 CRIP [Controlled Retracting Injection Point] experiment: Comparison of model predictions with field data.** Britten, J.A.; Thorsness, C.B. (Lawrence Livermore National Lab., CA (USA)). 1 Aug 1988. Contract W-7405-ENG-48. 8p. (CONF-880874—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015436/JAW.

From 14. annual underground coal gasification symposium; Schaumburg, IL, USA (15 Aug 1988).

The recently completed Rocky Mountain I (RM I) underground coal gasification (UCG) experiment has provided a wealth of data with which to test the performance of our UCG reactor dynamics model, described at the previous two symposia. Model results are compared in detail with process data from the first two cavities of the RM I Controlled Retracting Injection Point (CRIP) module. In addition to using detailed injection schedules and physico-chemical properties relevant to Hanna coal, overburden spalling parameters extracted from laboratory experimental data were used as input, making this simulation as free as possible of adjustable parameters. Although no field data exist for detailed comparison of model and true reactor geometry, model results for product flow rates and compositions, coal volumes and water influx compare very well with field data. Calculated water influx transients were found to be overly sensitive to pressure changes, and model predictions for product gas and cavity temperatures differ from field data, but overall results reinforce our conclusion that the model is capable of near-quantitative prediction of UCG reactor sweep and gas production rates and is therefore quite useful for site characterization and process simulation. 9 refs., 11 figs., 2 tabs.

48060 **(UCRL—98643) Resource recovery and cavity growth during the Rocky Mountain 1 field test.** Cena, R.J.; Britten, J.A.; Thorsness, C.B. (Lawrence Livermore National Lab., CA (USA)). 1 Aug 1988. Contract W-7405-ENG-48. 12p. (CONF-880874—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015437/JAW.

From 14. annual underground coal gasification symposium; Schaumburg, IL, USA (15 Aug 1988).

Resource recovery and cavity growth remain important issues affecting performance, scale-up and overall process efficiency for underground coal gasification (UCG). Results from the recently completed dual-module Rocky Mountain I (RM I) UCG experiment give us firsthand information concerning these important parameters. During the RM I test, two gasifiers, the Controlled Retracting Injection Point (CRIP) and the Extended Linked Well (ELW) modules, were operated simultaneously. These modules differed in well completion geometry and to a lesser extent in operating strategy. Using material balance, thermowell and tracer gas information, cavity development, gas production rates and yields, and general features of the two modules are discussed and compared. Also, the linking phase of the test is described, and effects of process parameter changes on system performance are discussed. The major conclusion obtained from data analysis is the importance of maintaining oxidant injection low in the coal seam at all times. Performance of the CRIP gasifier, for which the above condition was met, is shown to compare very favorably with performance of surface gasifiers. 10 refs., 15 figs., 3 tabs.

48061 **(UCRL—98929) Assessment of the CRIP [Controlled Retracting Injection Point] process for underground coal gasification: The Rocky Mountain I test.** Cena, R.J.; Thorsness, C.B.; Britten, J.A. (Lawrence Livermore National Lab., CA (USA)). 1 Aug 1988. Contract W-7405-ENG-48. 21p. (CONF-880850—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015452/JAW.

From American Institute of Chemical Engineers summer national meeting; Denver, CO, USA (21 Aug 1988).

Results of the recently completed Rocky Mountain I (RMI) underground coal gasification (UCG) field test have shown that the Controlled Retracting Injection Point (CRIP) process for UCG is capable of producing consistently high quality gas from a single injection well for an extended period of time. The RMI CRIP module was in operation for 93 days and gasified over 10,000 tonnes (11,023 tons) of coal, with an average dry product heating value of 253 kJ/mol (287 Btu/scf). The CRIP process, which utilizes a horizontally drilled injection borehole, has the advantage over vertical well process techniques in that it maintains oxidant injection low in the coal seam for optimal resource recovery, and provides a method for reignition of the coal in a different location when gas quality declines as the maturing reactor begins to interact with inert overburden. This report discusses the results of the RMI CRIP module, compares its performance with the simultaneously operated Extended Linked Well (ELW) module, and explains the behavior of the CRIP reactors with the aid of a model developed for describing UCG reactor dynamics for cases in which oxidant injection remains low in the coal. It is shown that both in terms of fundamental understanding and practical application, the CRIP process for UCG in subbituminous and lower ranking coals has reached a level where the remaining technical uncertainties and risk to commercial development have been largely reduced. 6 refs., 8 figs., 4 tabs.

48062 **Low temperature pyrolysis of coal or oil shale in the presence of calcium compounds.** Khan, M.R. (to Dept. of Energy, Washington, DC). US Patent 4,747,938. 31 May 1988. Filed date 17 Apr 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A gasification method for the production of liquid and gaseous products from carbonaceous materials, is described consisting of the steps of heating at a rate in the range of about 5° to 50°C per

minute a particulate mixture consisting essentially of carbonaceous material selected from coal or oil shale in an average particle size range of about 8 to 100 mesh and about 5 to 25 wt.% of a calcium compound of an average particle size of less than about 325 mesh to a pyrolysis temperature in the range of about 450° to 700°C, maintaining the mixture at a temperature within the range for a duration of about 10 to 60 minutes, and removing liquid and gaseous products generated during the pyrolysis of the carbonaceous material.

0105 By-products

REFER ALSO TO CITATION(S) 48159

0106 Properties

REFER ALSO TO CITATION(S) 48025, 48029, 48030, 48056, 48108, 49149

48063 (ACI—85-153) Correlation of mineral, maceral, and petrophysical characteristics of coal to beneficiation technology, final report. (Atlantic Coal Inst., Sydney, Nova Scotia (Canada)). Dec 1986. 303p. CANMET, 555 Booth St, Ottawa, Ontario, Canada, K1A 0G1.

Increasing utilization of high sulphur or lower quality coals has made investigations into methods of upgrading or beneficiation of these coals necessary. Based on a review of the literature on mineral beneficiation as applied to coal preparation, a number of areas were identified as requiring further study. These included: coal petrography, particulate behavior, and mineralogy at various stages of beneficiation. This study was undertaken to examine some of these issues. Its objectives included: 1) laboratory investigation of two Eastern Canadian coals to define mineral and maceral characteristics; 2) application of high purity mineral and maceral group separation to the factors relevant to coal washability; 3) application of scanning electron microscopy and energy dispersive x-ray microanalysis to coal minerals and macerals; and 4) to investigate the relationship between fluidity dilatometric measurements of the coals and washability. Results are presented in the extensive appendices. 73 tabs., 7 figs.

48064 (CONF-860548—) Coal slurry fuels preparation and utilization: Proceedings. (USDOE Pittsburgh Energy Technology Center, PA). 1986. 969p. NTIS, PC A99. Order Number DE88012263/JAW.

From 8. international symposium on coal slurry fuels preparation and utilization; Orlando, FL, USA (27 May 1986).

Proceedings on a symposium of coal slurry fuels is presented. Research is discussed in the following areas: Coal Slurryability; Slurry Fuel Rheology; Slurry Fuel Atomization; Beneficiated Coal Slurry Fuels; Coal-Based Fuel Options; Fundamentals of Slurry Fuel Combustion; Small Scale Combustion Tests; Large Scale Combustion Tests; Ultrafine Coals and Heat Engines; Slurry Fuel Burners and Combustors; Slurry Fuel Retrofit Engineering; Demonstration Projects; Slurry Preparation Processes; Slurry Fuel Transportation and Handling; and Commercial Ventures. Individual projects are processed separately for the databases. (CBS)

48065 (CONF-880912—12) The importance of diphenylmethane-like structural units in an Argonne premium coal sample. Chambers, R.R. Jr.; Hagaman, E.W.; Woody, M.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number TI88012484/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

Our approach for characterizing the acidic C-H bonds in coal is to treat O-methyl coal with a series of indicator bases, BLi, followed by methylation with C-13,14 double labelled methyl iodide. By varying the identity of BLi, and thus the pK/sub a/ of the conjugate acid BH, it is possible to evaluate the number of C-H bonds as a function of pK/sub a/. The application of this approach to two bituminous coals, namely Illinois No. 6 hvCb and PSOC 1197 lvb, led to the discovery of a significant concentration of acidic C-H sites with 18.5 < pK/sub a/ ≦ 22 which was interpreted as evidence for fluorene-like structural units in coal. 13 refs., 1 tab.

48066 (CRL—87-116(TR)) An improved technique for determination of spontaneous combustion susceptibility of coals. Mansour, N.A.; Chakravorty, R.N. (Canada Centre for Mineral and Energy Technology, Devon, Alberta. Coal Research Lab.). Nov 1987. 17p. Canada Centre for Mineral and Energy Technology, Sydney, Novia Scotia. Cape Brenton Coal Research Lab.

This report discusses the development of cubic spline mathematical formulations for representing crossing point data more effectively for categorizing coals with respect to their susceptibility to spontaneous combustion. The technique is used to fit data for two types of coal, high and low volatile. 5 refs., 4 tabs., 2 figs.

48067 (DOE/PC/70782—13) Electron spin mapping of coal molecular structure by ENDOR [Electron-Nuclear Double Resonance]: Quarterly technical progress report. Belford, R.L. (Illinois Univ., Urbana (USA)). 15 Oct 1987. Contract FG22-84PC70782. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013128/JAW.

It is our primary goal to examine commercially available sulfur- containing heterocyclic compounds using EPR and ENDOR spectroscopies to investigate the characterization of these model compounds so that ultimately coal components may be characterized as well. In preparing the samples of the sulfur containing heterocycles, the solutions of the compounds were applied onto alumina and silica-alumina catalyst surfaces. These catalysts were used to produce the paramagnetic species required to perform EPR and ENDOR spectroscopies. This raises some questions concerning the nature of the surface chemistry involved in the radical production process. In addition to these projects, coal itself was analyzed to obtain any useful information from the spectra. The examination of coal and its derivatives using EPR and ENDOR had special problems that are discussed. These problems made obtaining useful spectra very difficult. Variations of the factors that affect the shape and intensity of the signals produced by coal and some liquid derivatives were examined to optimize their spectral features. 11 refs., 8 figs., 2 tabs.

48068 (DOE/PC/70784—T11) Solubilities and liquid phase nonidealities in coal liquids: Final report, July 30, 1984-July 30, 1987. McLaughlin, E.; Coon, J.E. (Louisiana State Univ., Baton Rouge (USA)). [1988]. Contract FG22-84PC70784. 202p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88000909/JAW.

The research effort was a three year study of the solubilities of polynuclear aromatic hydrocarbons (PAH's) in organic solvents and the vapor-liquid equilibria of some of these same systems. Solubilities of 102 systems were determined as functions of temperature from ambient temperature to the melting point of the solute. The systems are listed and results are presented. Solubility data were analyzed using four solution models (Regular Solution theory, Extended Regular Solution theory, Wilson's Equation, and UNIQUAC) and binary interaction parameters have been obtained for the liquid phase. Also included are analyses of 35 more systems that have been previously published, for the purpose of composition of the predicted activity coefficients. Vapor pressures were determined for five solvents versus temperature. Also determined were the vapor-liquid equilibria for a test system and for six new systems at three temperatures each. New systems are (tetralin-decalin, tetralin-biphenyl, decalin- biphenyl, tetralin-fluorene, tetralin-fluorene, tetralin- dibenzothiophene, and tetralin-dibenzofuran. Results have been analyzed using four common solution models (Wilson's, UNIQUAC, NRTL, and Van Laar) and the optimum binary parameters determined. We have compared the parameters (for Wilson's and UNIQUAC) for the two methods and discussed the pros and cons of each method as a source for these parameters. Some initial steps have been made towards utilizing statistical mechanical methods for these types of systems. 46 refs., 26 figs., 57 tabs.

48069 (DOE/PC/79903—2) Optical properties of fly ash: Quarterly report, 1 January-31 March 1988. Self, S.A. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). Apr 1988. Contract AC22-87PC79903. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013716/JAW.

The primary objective is the measurement of the infrared optical constants of fly ash and coal slags as a function of composition, wavelength (0.5-12 μm) and temperature (300-2000K), to provide essential data for reliable computation of radiation heat transfer in coal combustion and gasification systems where one has particle-laden, hot combustion-products gases. Because it is not feasible to measure the optical constants of particulate matter, the basic approach is to make such measurements on bulk samples of slag in the vitreous state (solid or liquid). Two tasks are initially funded. Under Task I, fly ash from the combustion of representative pulverized coals will be characterized with respect to particle size and composition. Under Task II, the optical constants of bulk samples (solid and liquid) of synthetic slags of a range of composition determined by Task I will be measured. From these measurements a set of correlation formulae will be developed for the optical constants of ashes and slags as a function of composition, wavelength and temperature. 17 refs., 23 figs., 2 tabs.

48070 **(DOE/PC/79914—T1) Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, December 15, 1987--March 15, 1988.** Peppas, N.A. (Purdue Univ., Lafayette, IN (USA). School of Chemical Engineering). 1988. Contract FG22-87PC79914. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013724/JAW.

During this funding period we proceeded with the design and building of the new interferometer/polariscope for the determination of penetrant concentration and stress profiles in coal samples. We also conducted some experimental studies of penetrant transport in thin coal sections. 21 refs., 3 figs., 1 tab.

48071 **(DOE/PC/90539—T5) Volatiles trapped in coals: Third quarterly report.** Sutter, J.R.; Halpern, J.B. (Howard Univ., Washington, DC (USA). Dept. of Chemistry). 1987. Contract FG22-86PC90539. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014651/JAW.

We have completed the first set of measurements to compare the heating values of ground and unground coal from the same samples. Heating values were measured by complete combustion in a Parr bomb calorimeter. In these measurements we have corrected for sulfur, nitrogen, fuse wire and water. Comparisons were made only between the ground and unground versions of the same coals. TG Analysis was used to determine the water content of the coal. The water content of the unground coal was taken to be the physically adsorbed water, which was liberated below 200{degree}C. Other water, chemically bound, was freed above 200{degree}C. 2 figs., 3 tabs.

48072 **(SAND—87-1971) Coal/water slurry rheology and atomization.** Lynch, A.W.; Cook, D.W.; Dunn-Rankin, D. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015830/JAW.

The initial Sandia program in coal/water mixtures consisted of adapting helical screw rheometer technology for use in determining the flow behavior of coal/water slurries. The program required the development of a variety of experimental and analytical techniques and initially focused on determining rheology in the low-intermediate (50--250 sec/sup {minus}1/) shear rate range. The thrust of the current program is to extend the investigations from shear rates in the transportation and pumping range to those expected during atomization. The program consisted of the following elements: (1) design, fabricate and test a helical screw rheometer capable of developing shear rates to 10,000 sec/sup {minus}1/; (2) develop a capability to atomize slurries and monitor the spray using high speed photography; and (3) establish a collaborative program with the Combustion Research Facility at Sandia National Laboratories Livermore for the purpose of analyzing particulates in atomized and burned spray. 11 refs., 10 figs.

48073 **(SSW—025) Studies of coal oxidation using ion microscopy and X-ray photoelectron spectroscopy: Phase III, final report.** Martin, R.R.; Aye, K.T.; Johnston, D.D.; McIntyre, N.S. (Western Ontario Univ., London (Canada)). Mar 1987. 95p. CANMET, 555 Booth St, Ottawa, Ontario, Canada K1A 0G1.

This report is the third phase of a study on the mechanisms of coal oxidation. In Phase III, the oxidation conditions studied involve typical storage temperatures over a range of pressures. Two surface-sensitive spectroscopic techniques are used for the study: secondary ion mass spectrometry (SIMS) and X-ray photoelectron spectroscopy (XPS or ESCA). SIMS is used to locate specific microscopic sites for oxygen fixation on a coal surface, while XPS is used to measure sulphur and carbon chemical changes which occur during oxidation. Tests were conducted on samples of mineral-rich and demineralized vitrinite and fusinite. Site specific reagents were also used in conjunction with SIMS to identify functional groups specifically involved in surface oxidation. 14 refs., 23 figs.

0108 Waste Management

REFER ALSO TO CITATION(S) 48027, 48109, 48111, 48498, 48499, 48500, 49522, 49584

48074 **(AD-A—193312/6/XAB) Laboratory testing of a fluidized-bed dry-scrubbing process for removal of sulfur dioxide and phosphorous pentoxide from an inert carrier gas. Final technical report, February-October 1987.** Bradshaw, W.M. (Oak Ridge Associated Universities, Inc., TN (USA)). Mar 1988. 59p. (ORNL/TR—10753). NTIS, PC A04/MF A01.

A series of tests was conducted to evaluate a dry-scrubbing process in which acidic gases are removed from an inert carrier gas stream by contact with lime in a fluidized bed operating in the bubbling-bed regime. The acidic gases studied were sulfur dioxide and phosphorus pentoxide. The process parameters studied include temperature, gas flow rate, humidity, and acidic gas inlet concentration. At the conditions tested, the removal efficiency typically exceeded 99%. However, lime utilization > 9% was not tested. Test data indicate that sulfur dioxide and phosphorus pentoxide readily react with calcium oxide in a bubbling bed operating between 480 and 650 C (900 and 1200 F).

48075 **(CANMET—86-9E) Evaluation of SO_2 sorbent utilization in fluidized beds.** Hamer, C.A. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Dec 1986. 82p. Canadian Government Publishing Centre, Ottawa. In Canada: 16.00 dollars, Other Countries: 19.20 dollars.

This report presents results of an investigation of Canadian limestones and dolomites as SO_2 sorbents, which took place over a five year period. Tests were conducted on more than forty samples from twenty-five deposits and quarries in Nova Scotia, New Brunswick and Alberta. A bench-scale fluidized-bed reactor was developed to test limestone in a synthetic flue gas at atmospheric fluidized-bed combustion operating temperatures. Several techniques investigated to improve sorbent utilization included: using finely ground and pelletized limestone; hydrating partially sulphated bed material; and, grinding and pelletizing used bed material. The sulphation curve equation obtained from the fluidized bed reactor tests are combined with the operating data of large-scale FBR units to predict the performance of sorbents in the Argonne National Laboratory model. The resulting performance data correlate well with actual data from AFBC units at CCRL and Summerside. 44 refs., 21 tabs., 32 figs.

48076 **(CRIE—486014) Growth of crops on fly ash treated soils: Relationship between crop yield and variation in chemical properties as well as leaching of elements from fly ash/soil mixture.** Aoki, Masanori; Umezawa, Takeshi; Nakaoka, Akira; Seki, Teruo. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Nov 1987. 21p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753436/JAW.

As a part of effective utilization and mass disposal of fly ash, this study aimed at examining relationship among growth and yield of crops grown on the fly ash treated fluvial soil, absorption of inorganic elements and variation of chemical properties of the soil as well as leaching elements therefrom and obtaining the basic materials for grasping the lasting effect of fly ash and the environmental effect of leaching elements. In this experiment, 6 crops of aquatic

rice and 1 crop of wheat were cultivated in 6 years on the fly ash treated fluvial soils (weight ratio between fly ash and soil: 0-50%). Concerning the crop yield of aquatic rice from the 10% fly ash/soil mixture sector, it exceeded considerably the crop yield of the reference sector (fluvial soil) up to the third crop, but from its fourth crop in the third year onwards, it showed only a slight increase. With regard to the crop yield of aquatic rice from the 30% fly ash/soil mixture sector, it showed a considerable decrease in the beginning of the mixture, but its second and third crops showed considerable increases. Nevertheless, from its fourth crop onwards, it showed almost the same as that from the reference sector. The decline of crop yields is mainly due to strong alkalinization of the soil and the excess concentration of boron. In addition, among the elements eluting from the fly ash treated soil, calcium shows the largest amount, boron is few, and arsenic and chrome do almost not elute. (8 figs, 7 tabs, 4 refs)

48077 **(DOE/FC/10619—2519) Microbial degradation of acenapthene and napthalene under denitrification conditions in soil--water systems: Annual report, October 1987.** Mihelcic, J.R.; Luthy, R.G. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Civil Engineering). Oct 1987. Contract AC21-84FC10619. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001016/JAW.

This study examined the microbial degradation of acenaphthene and naphthalene under denitrification conditions at soil-to-water ratios of 1:25 and 1:50 with soil containing approximately 10^5 denitrifying organisms per gram of soil. Under nitrate-excess conditions, both acenaphthene and naphthalene were degraded microbially from initial aqueous-phase concentrations of about one and several mg/l, respectively, to nondetectable levels (<0.01 mg/l) in time periods less than 9 weeks. Acclimation periods of 12 to 36 days were observed prior to the onset of microbial degradation in tests with soil not previously exposed to PAH, while acclimation periods were absent in tests with soil reserved from prior PAH degradation tests. It was judged that the apparent acclimation period resulted from the time for a small population of organisms capable of PAH degradation to attain sufficient densities to exhibit detectable PAH reduction. About 0.9 percent of the naturally occurring soil organic carbon could be mineralized under denitrification conditions, and this accounted for the greater proportion of the nitrate depletion. The mineralization of the labile fraction of the soil organic carbon via microbial denitrification occurred without an observed acclimation period, and was rapid compared to PAH degradation. Under nitrate-limiting conditions the PAH compounds were stable owing to the depletion of nitrate via the more rapid process of soil organic carbon mineralization. The microbial degradation of the PAH compound depends on the interrelationships between: the desorption kinetics and the reversibility of desorption of sorbed compound from the soil, the concentration of PAH-degrading microorganisms, and the competing reaction for nitrate utilization via mineralization of the labile fraction of naturally occurring soil organic carbon. 44 refs., 10 figs.

48078 **(DOE/MC/21281—2562) Anaerobic wastewater treatment: Final report.** Suidan, M.T.; Pfeffer, J.T.; Nakhla, G.F.; Fraser, J.; Klepp, B.E.; Mueller, P.A. (Illinois Univ., Urbana (USA). Dept. of Civil Engineering). Nov 1987. Contract AC21-84MC21281. 207p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88001062/JAW.

This project was undertaken to evaluate the effects of wastewater dilution, GAC (granular activated carbon) replacement rate, GAC particle size, operating temperature, and reactor configuration on the treatment of coal gasification wastewater with the expanded-bed GAC anaerobic bioreactor. Coal gasification wastewater used was generated in a low BTU, elevated pressure, stirred fixed-bed, gasifier operated by Morgantown Energy Technology Center (METC) in Morgantown, West Virginia. The treatability of another wastewater generated in a full-scale, slagging fixed-bed modification of a conventional dry-ash, pressurized gasifier located at the Great Plains gasification Association (GPGA) facility in North Dakota was also evaluated. Full-strength METC wastewater was found to be effectively treated at chemical oxygen demand (COD) loading rates as high as 19.4 g/kg GAC-day. At this rate, an excess of 50% of the applied COD was converted to methane, and a carbon utilization rate of 10 g GAC per liter of wastewater treated was employed. At these operating conditions, COD removal efficiencies across the treatment system exceeded 95%. Good COD removal and efficient COD conversion to methane were attainable at loading rates exceeding 70 g COD/kg GAC-day. Wastewater generated at the GPGA facility was found to be treatable at full-strength in the expanded-bed GAC anaerobic reactor at COD loading rates as high as 48 g COD/kg GAC-day. COD removal efficiencies at this loading rate exceeded 90%. Coal gasification wastewater was found to resist treatment under thermophilic anaerobic conditions. The thermophilic expanded-bed GAC anaerobic reactor affected very poor conversion efficiencies of phenol, even when fed a synthetically prepared phenol bearing wastewater. 29 refs., 77 figs., 16 tabs.

48079 **(DOE/MC/23089—2601) Dynamic simulation models for high-temperature desulfurization processes: Final report.** Wang, J.; Cockrill, D.; Groves, F.R.; Harrison, D.P. (Louisiana State Univ., Baton Rouge (USA). Dept. of Chemical Engineering). Mar 1988. Contract AC21-86MC23089. 164p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88010263/JAW.

Dynamic simulation models capable of describing the high temperature sulfidation and regeneration reactions of metal oxide sorbents in fixed-, fluidized-, and moving-bed reactors have been developed. In the sulfidation phase energy effects are minimal and the models are based upon the appropriate component material balances in both the gas and solid phases. Individual particle kinetics for the fixed- and moving-bed reactors are based upon the unreacted core model. The isothermal fixed-bed model can predict the H_2S concentration and sorbent sulfur loading in the reactor as a function of time and axial position, as well as the reactor effluent H_2S concentration as a function of time. Model results compare favorably to experimental data from laboratory fixed-bed reactors when the effective diffusivity is treated as an adjustable parameter. Similarly, experimentally determined temperature profiles during sorbent regeneration can be matched at least qualitatively using the nonisothermal fixed-bed reactor model. The fluidized-bed model is based upon the Kunii-Levenspiel three-phase bubble description of the fluidized-bed. Modified equations capable of describing a batch fluidized-bed reactor were also developed. The moving-bed model is based upon the assumption of plug flow of both the gas and solid phases. 55 refs., 74 figs.

48080 **(NP—8770309) Utilisation of by-products from fluidized-bed combustion. Final report.** Huth, H. (Steinmueller (L.U.C.) G.m.b.H., Gummersbach (Germany, F.R.). Fachbereich Forschung und Entwicklung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1987. 107p. (In German). NTIS (US Sales Only), PC A06. Order Number DE88770309/JAW.

The by-products from fluidized-bed firing systems (FBC) differ considerably in nature from those produced by conventional firing systems: As a result of the low combustion temperature of 850/sup 0/C the minerals associated with the coal are only partly fused and as a result of the additives used employed in desulfurization, the products of combustion tend to aggregate in the ash. Six main possibilities for the utilisation of the fluidized-bed ash are outlined: The production of cement flour, cement additive while grinding, concrete additive, steam-hardened construction materials, additives in brick-making and strenghening load-bearing soil surfaces, additive for bituminous road surfaces, unmetaled path surfacing. Very promising results have been attained which will certainly provide concepts in the future. (orig.) With 5 refs., 11 tabs., 33 figs.

48081 **(NP—8770361) Retention of fluorine and chlorine in flue gas of fluidized combustion plants by mixtures of sorbent and bed-ash. Final report.** Muenzner, H. (Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1986. 81p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770361/JAW.

The halogens fluorine and chlorine present in the mineral matter of coals are being transferred during coal combustion into volatile hydrogen halides with increasing combustion temperature to an increasing degree by pyrohydrolysis. These gases then appear

in the flue gas. The degree of fluorine emission at 850/sup 0/C increases with grain size, but is limited to 50 % +- 10 % for a grain size of about 5 mm, and to 30% +- 10% for broad grain ranges 0-5 mm. By lime sorbent fluorine can be retained extensively. The degree of chlorine emission scarcely depends on grain size. Most of chlorine is emitted, but with high excess of active sorbent powder a considerable part may be retained, too. High sorbent excess just increase NO/sub x/ emission countercurrently. These results are produced in a lab-FBC of staged tube diameter and with staged air combustion. In this way the emission results of pollutants and of carbon loss are placed near those of technical plants, especially those of NO/sub x/, demonstrating, that the combustion conditions are comparable. The entire review for all pollutants (not only halogens) and for carbon loss shows the interdependencies: NO/sub x/ emission depends on O/sub 2/-concentration profile, low O/sub 2/ concentration causes low NO/sub x/- but high CO-emission and high carbon loss. Limestone excess retains SO/sub 2/ and halogens, but increases NO/sub x/. (orig.) With 6 refs., 7 tabs., 40 figs.

48082 **(NP—8770368) Constructing and operating a denox pilot plant with a zeolit-catalyst on a hard coal fired furnace. Final report.** Brinkmann, J.; Poller, J. (Vereinigte Elektrizitaetswerke Westfalen A.G. (VEW), Dortmund (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Nov 1987. 82p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770368/JAW.

A pilot plant with a capacity of 10,000 m/sup 3//h (s.c.) for the selective catalytic reduction of nitrogen oxides had been installed and operated on a hard coal fired furnace with slagging ash removal. The high dust plant was equipped with a zeolitic catalyst. Regarding a future scale-up, the catalyst's qualities in NO-reduction and durability were analysed under typical power plant conditions. Further, the effect of catalytic NO-reduction on the deposit of salts on the surfaces of preheaters was explored. Additional investigations, referring to the catalyst's deactivation and the salt deposit, were carried out in a laboratory plant. Although the catalyst's volume had been enlarged repeatedly, the experiment's aim, reducing nitrogen oxides by about 90% with an amount of unreacted ammonia of less than 5 ppm, could not be achieved. This was obviously caused by obstraction and erosion of the catalyst as an effect of fly ashes, the catalyst's deactivation and the non-ideal velocity profile inside the reactor. (orig.) With 2 tabs., 22 figs.

48083 **(NP—8770372) Development of technology for reducing the emission loading in coal-fired heating boiler plants in the load range up to 1.5 MW. Final report.** Driesen, R.; Bornscheuer, W. (Viessmann K.G., Allendorf (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1987. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770372/JAW.

A dry additive process for reducing the SO/sub 2/ emission was developed and tested for a special coal-fired boiler with underfeed firing in the range 0.375 to 1.5 MW. Powdered limestone (CaCO/sub 3/) is used as the additive, which is blown by a carrier air blower into the cylindrical combustion space directly above the secondary air nozzles. The assessment of the series of experiments on a 1.5 MW boiler gave a maximum value of SO/sub 2/ reduction of about 60% with a practical Ca/S mol ratio of 3.0 at 65% of nominal boiler load and an SO/sub 2/ reduction of about 55% at the full nominal boiler load. The additive dust is separated at a subsequent fabric filter, where part of the quantity of dust which occurs in the stilling basin of the boiler, is returned to the additive circuit. The process is being tried in a pilot plant with a boiler output of 475 kW in a long term test. The effective reduction of emission is to be documented for interested users.

48084 **(PB—88-207014/XAB) Ash: a valuable resource. Volume 1. Production and general utilization of ash.** (Council for Scientific and Industrial Research, Pretoria (South Africa)). Feb 1987. 150p. NTIS, PC E07/MF E07.

See also Volume 2, PB—88-207022; North American Continent sales only.

Ash, a waste product of ore and mineral treatment, has many actual and potential uses in South Africa. Topics discussed in the presentations delivered at this conference covered the mineral industry and its waste products, as production, ash marketing and utilization in the United States over the past 50 years, the output of ash from hard coal power stations and its usage in the Federal Republic of Germany, aspects of disposal of ash including environmental and resource recovery issues associated with coal combustion, marketing of fly ash in South Africa, use of by-products from lignite coal burned in the western United States in the manufacture of mineral wool, and ash utilization and disposal in Austria, Israel, and Italy.

48085 **(PB—88-207022/XAB) Ash: a valuable resource. Volume 2. Concrete.** (Council for Scientific and Industrial Research, Pretoria (South Africa)). Feb 1987. 395p. NTIS, PC E16/MF E16.

See also Volume 1, PB—88-207014, and Volume 3, PB—88-207030; North American Continent sales only.

Concepts relating to the utilization of ash in cement-bonded products are presented. Topics covered include a general overview of the approaches to utilization, range of fly-ash qualities in the Federal Republic of Germany and associated processing methods, use of pulverized fuel in the United Kingdom viscosity measurements on cement, role of alkalis, the mobility of ions in mortars, fly-ash performance in plastic concrete, curing regimes, slow crack behavior in hardened-cement paste, the role of admixtures in use of fly ash and silica fume, use of ash in various types of concretes and concrete structures, mixing Portland cement and ash, and use of ash as a lightweight aggregate for structures subject to vibration.

48086 **(PB—88-207030/XAB) Ash: a valuable resource. Volume 3. Environmental aspects - special products - mineral beneficiation.** (Council for Scientific and Industrial Research, Pretoria (South Africa)). Feb 1987. 371p. NTIS, PC E15/MF E15.

See also Volume 2, PB—88-207022, and Volume 4, PB—88-207048; North American Continent sales only.

Environmental and related issues related to fly ash and use of ash and other products of mineral beneficiation are discussed. Topics covered include agricultural use of ash, ash in solidification of metal-bearing sludges, chemical attributes of fly ash, coal ash use in structured reed beds for effluent treatment, government regulation and ash utilization, disposal of power-station fly ash in South Africa, trace elements in coal-combustion residues, leaching and other water-quality issues, aluminum recovery, uranium-bearing coal-ash residues, magnetic-separation equipment, mineral recovery from ash and scrubber sludge, composition variations of fly ash, fly-ash bricks, and manufacture of aggregate from pulverized fuel ash.

48087 **(PB—88-207048/XAB) Ash: a valuable resource. Volume 4. Ash handling/transportation-roads-engineering fill-marketing.** (Council for Scientific and Industrial Research, Pretoria (South Africa)). Feb 1987. 368p. NTIS, PC E15/MF E15.

See also Volume 3, PB—88-207030; North American Continent sales only.

Handling and transportation issues related to fly ash and other ash products and use of ash in road construction are discussed. Topics covered include transportation in powdered and paste forms, aerobelt conveyors, hydraulic transport, use of the Japan Pipe Conveyor, storage of hot ash via concrete bunkers, management of ash at large power stations in South Africa, Erosion of pulverized fuel ash, dense-phase pneumatic conveyance of ash in the South African market, use and performance of ash in road construction and soil stabilization, mining applications of fly ash, engineering properties of power-station precipitator ash, and fly ash marketing.

48088 **(PB—88-220694/XAB) Automation of the resistivity measurement for fly ash.** Nolen, S.L.; Ramsey, G.H.; Elliott, D.E. (Acurex Corp., Research Triangle Park, NC (USA)). Jun 1988. 13p. NTIS, PC A03/MF A01.

The article describes the automation of the resistivity measurement for fly ash. Fly-ash resistivity is an important consideration in the operation of particulate-control devices based on electrostatic principles (the higher the resistivity of the fly-ash, the more difficult it is to collect). Because of the need for characterization of fly

ash resistivity and the large amount of time required to conduct the manual test, it was decided to automate the test. A standard (STD) bus computer was used in the automated test to monitor the temperature, collect current readings, and transfer the data to a personal computer. The personal computer was programmed to calculate and plot the results from the data received from the STD computer. The automated system tracks the manual system closely. It also consistently produces smoother curves and is very precise for duplicate runs. Most importantly, operator time for the test was reduced from about 6.5 hours per test to about 1 hour, thereby improving productivity.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 48127, 48166, 49584

48089 **(CRL—87-126(TR)) Graphics modifications to the US Bureau of Mines MONVER3.BAS subsidence prediction program.** Keddy, B.; Aston, T.R.C. (Canada Centre for Mineral and Energy Technology, Sydney, Nova Scotia. Cape Breton Coal Research Lab.). Nov 1987. 11p. Canada Centre for Mineal and Energy Technology, Sydney, Novia Scotia. Cape Brenton Coal Research Lab.

Modifications to the US Bureau of Mines MONVER3.BAS subsidence prediction program were undertaken to enable the program to graph subsidence, inclination and curvature parameters on an HP 7475A plotter. 1 ref., 2 tabs., 3 figs.

48090 **(CSIRO-DG-TR—146) Three-dimensional numerical modelling of surface subsidence induced by underground mining.** McNabb, K.E. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Geomechanics). Jul 1987. 23p. Commonwealth Scientific Industrial Research Organization, Mount Waverley (Australia). Div. of Geomechanics.

This report presents three-dimensional numerical analyses of the surface subsidence induced by the total extraction of a longwall panel. The finite element and displacement discontinuity stress analysis methods were used to obtain linear elastic solutions for an idealised subsidence problem. Subsidence profiles are presented for a number of panel length to width ratios and for a range of anisotropic material values. Model predictions show that a 5:1 (length to width) aspect ratio produces results equivalent to a two dimensional idealisation when a linear elastic isotropic material model is used. The results also show that anisotropic are better than isotropic material models in producing a closer fit to observed subsidence profiles. The need for careful consideration and appreciation of the generalizations used in the numerical models is also indicated.

0110 Reserves And Exploration

48091 **(NP—8770300) Development and testing of an electromechanical impulse generator system for in-seam seismics in hardcoal mining. Final report.** Haas, H. (Ruhrkohle A.G., Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1987. 25p. (In German). NTIS (US Sales Only), PC A03. Order Number DE88770300/JAW.

In 1985, in contrast to the original planning, a hydraulic vibration generator system was designed, and manufactured in 1986. This system induced considerably higher sonar energy than electromechanical systems, and within a series of tests with the manufacturer, it was tested for the limits of its capacity. Frequencies of round about 1100 Hz and energies of approx. 7.25 KN could be recorded. Early in 1987 the hydraulic vibration generator system underwent underground testing together with the receiver system Seamex 85. The tests where run by WBK in comparison with explosives seismics. The evaluation of the measured values obtained by various discrete frequencies have shown that the energy induced into the seam results only in depths of penetration as required for short-range exploration. This result which is unsatisfactory for in-seam exploration over the required ranges, and the fact that performance improvement is unlikely resulted in premature cancelation of the project. (orig.) With 11 figs.

0120 Mining

REFER ALSO TO CITATION(S) 48089, 48090

48092 **(CRL—87-74(TR)) Pump calibration procedures for dust sampling instruments used at CBCRL.** Young, D.A. (Canada Centre for Mineral and Energy Technology, Sydney, Nova Scotia. Cape Breton Coal Research Lab.). Jul 1987. 35p. Canada Center for Mineral and Energy Technology, Sydney, Nova Scotia. Cape Brenton Coal Research Lab.

The various pumping systems and the calibration procedures used to maintain air flows to dust collection devices at the Cape Breton Coal Research Laboratory are described. Data obtained from 30 dust surveys undertaken at two underground coal mines was used to compare the performances of the pumping systems. 6 refs., 11 tabs., 7 figs.

48093 **(CSIRO-DG-TR—99) Computer program abstracts - April 1987: 4th edition.** Coulthard, M.A.; Perkins, B.R. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Geomechanics). Apr 1987. 66p. Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Geomechanics.

Programs held in the Division's Computer Program Library are categorised according to their availability for distribution under licence and for support. Abstracts are given for each program, outlining the scope of the program, the method used, the input data required and output produced. The report, previous editions of which were dated March 1980, February 1983 and December 1984, has been fully revised. In particular, many programs are now operational on a Vax/Unix system and/or on IBM PC series microcomputers.

48094 **(DOE/CE/15297—T3) Market research on mechanical stemming device: Part 3.** (Incubator Technologies, Inc., Rolla, MO (USA)). 1 Jun 1988. Contract FG01-86CE15297. 43p. NTIS, PC A03. Order Number DE88014590/JAW.

The stemming device has application for any explosive loaded blast hole. The primary market areas are coal mining, hard rock mining, and construction. An average of 7.6 million boreholes are drilled annually with 41{percent} in coal mining, 23{percent} in quarry operations, 21{percent} in construction, and 15{percent} in metal mining. There are no other stemming devices on the market. The current practice is to drill the hole, fill the hole with explosives, and stem the explosives by packing the rock cuttings on top of the explosive column. This conventional stemming material would also be used in conjunction with the stemming device. Thus, the stemming device is competing with a practice that has no material cost, i.e., the waste material from the drilling process. Therefore, the cost of the stemming device must be offset by an overall reduction in blasting cost through reduction in the number of holes drilled, related reduction in drilling labor costs, and improved fragmentation (reduction in secondary and tertiary crushing costs). In addition, the stemming device reduces the blasting noise which is a consideration in populated areas. The customer must be shown the net savings from using the stemming device. The stemming device is easily copied and manufactured and thus is expected to attract competition if it is successful. The strategy will be to establish the stemming device as the dominant force in the market supported by expertise in blasting applications, while reducing device manufacturing/material costs to the minimum.

48095 **(DOE/FE/00016—T139) Mine demonstration of longwall dust control techniques: Final report.** Pothini, B.R. (Island Creek Corp., Lexington, KY (USA)). 1 Jul 1988. Contract AI01-81FE00016. 226p. NTIS, PC A11. Order Number DE88013132/JAW.

This report represents the results of in-mine demonstration of three dust control techniques for controlling respirable dust levels on shearer-longwall faces. The techniques were: water infusion, foam spray and reverse shearer drum rotation. The mines in which tests were conducted were in Upper Freeport seam and Po-

cahontas No. 3 seam. Both gravimetric samplers and GCA RAM-1 real time dust monitors were used for dust surveys. Dust control technology was reviewed, pertinent techniques were selected, equipment was procured and demonstrated as part of the program. The results indicated that water infusion can be readily implemented, foam spray holds promise, but requires more work to be done, and reverse drum rotations effective in select conditions. The tests showed that reversing cutting drum rotation has brought several positive results: (1) lower dust levels; (2) lower methane liberations; (3) improved productivity and (4) less fines. Although the improvements were only in the 10% range, the costs except for the initial change of cutting drums are nil. Therefore this technique should further be tested in soft seams with thick binder rock and also in hard blocky seams. Such investigations may lead to universal application of reverse drum rotation in the industry for beneficial reductions in respirable dust levels at insignificant costs. 13 refs., 34 figs.

48096 **(NP—8770301) Floor slotting for maintaining cross-sections of mine workings. Final report.** Ludwig, G.; Neuhaus, M. (Ruhrkohle A.G., Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1987. 124p. (In German). NTIS (US Sales Only), PC A06. Order Number DE88770301/JAW.

Model experiments have shown that, by a slot in the floor, convergences can be considerably reduced, in particular in case of a soft floor. This was to be proven in the field, and equipment therefore had to be developed which later on could also be used for roadheading sites. Together with Maschinenfabrik Korfmann GmbH, a floor slotting machine was designed, however, not constructed because the results of the drilling method had to be waited for. Furthermore, there were technical risks. The drilling method means that, instead of a slot, 300 mm boreholes are drilled in line in short intervals. Demag Mannesmann constructed, for this method, a percussive drilling system with dry debris clearance on crawler mounting. The unit was good enough for tests, however, its performance had been insufficient for regular field use. In 6 different gates in the seams N and EG, 8 lengths totalling 1116 meters was drilled into. Only over 4 said lengths, this line of boreholes resulted in a max. 20% gain in terms of convergence. The reasons for this lack of success, viz. water and too large borehole centres could neither be foreseen nor avoided. As to the costs, the drilling method comes quite close to dinting. This finding meant stop of the project. (orig.) With 1 ref., 24 figs.

48097 **(NP—8770302) Development, manufacture and trial for universally operating shield to improve the roof control, particularly in case of sloping face. Final report.** Seebacher, G. (Koeckner-Becorit G.m.b.H., Castrop-Rauxel (Germany, F.R.); Kloeckner-Becorit G.m.b.H., Recklinghausen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jun 1984. 48p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770302/JAW.

This work aimed at an improvement of roof control especially in measures with sloping face conditions. The solution was a shield concept with variable kinematics. The hince forces between the shield components were calculated with finite elements. Parallel to this the concept was tested according to the requirements of systems engineering, however, a better solution could not be achieved. Development of a direct control valve failed likewise. On the other hand the electronic forepole control as a preliminary stage of a comprehensive shield control system with protection against interference could be proved in an underground trial. This protection against interference yet was set aside for financial reason. Weak points of the forepole control are the transducers but the trial showed that the principle of this control system is workable.

48098 **(PB—88-210521/XAB) Improved canopy air-curtain systems. Open File Report (Final), April 1983-April 1987.** Engel, M.R.; Johnson, D.F.; Raether, T.D. (Donaldson Co., Inc., Minneapolis, MN (USA)). Aug 1987. 293p. NTIS, PC A13/MF A01.

The objectives of the contract were to develop an improved canopy air curtain system for mining use. The canopy air-curtain concept offers an inexpensive solution to dust protection of an individual worker while not interfering with the production process. The purpose of this contract was to apply canopy air curtain concepts to a wider variety of mining equipment and operations. The work was conducted in four phases. In Phase I, canopy air curtains currently used in the mining industry were studied and concepts for mine mill air curtains were designed. During Phase II, canopy air curtains for retrofit on underground mining machines and enclosed cabs on surface mines were designed. The possibility of a gas purification module for protection from diesel contaminates was investigated. During Phase III, the canopy air curtain for retrofit on underground mining equipment and the air-conditioned, partially enclosed cab were fabricated and laboratory tested. Field maintenance and mine worthiness of the systems were excellent. During Phase IV, the air-conditioned, partially enclosed cab system was field tested.

48099 **(PB—88-212493/XAB) Coal mines, topography, surface features, and geology of the Newcastle area, King County, Washington. Data file.** Dunrud, C.R. (Geological Survey, Denver, CO (USA)). 1988. mag tap. NTIS CP T02.

Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. For price at 6250 bpi density, call NTIS Computer Products.

The tape contains primarily data (xxx.DAT) and annotation (xxx.ANN or xxx.CPY) files in ASCII CODE for an area located between Newcastle and Issaquah areas, King CO., WA between Washington State Plane Coordinates (code 4601) 1,672,000 and 1,699,000 and 191,000 and 203,000 (Area 1: Xmin, Xmax;Ymin, Ymax=1,672,000; 1,685,000, 194,500, 203,000; Area 2: Xmin, Xmax, Ymin, Ymax-1,685,000; 1,699,000, 191,000, 199,000) in T. 24 N., R. 5 and 6 E. File numbers sequentially relate to original names, which relate to file topics.

48100 **(PB—88-213558/XAB) Design, fabrication, and testing of a hopper-feeder-bolter. Open File Report (Final), September 1977-December 1986.** Giroux, D. (Engineered Systems and Development Corp., San Jose, CA (USA)). 27 Apr 1987. 80p. (R—4145). NTIS, PC A05/MF A01.

This report documents the design, fabrication, testing, and coal-mine demonstration of a hopper-feeder-bolter during a four-phase program for the U.S. Bureau of Mines. The machine was designed to increase productivity and safety in underground room-and-pillar mining. It performed well as a hopper-feeder for continuous haulage during a coal-mine demonstration. Testing in a simulated mine showed that the machine also has good roof-bolting capability.

0130 Transport And Handling

48101 **(DOE/PC/90956—T4) Advanced instrumentation for local measurement of gas-solid suspension flows: Quarterly technical progress report No. 5 November 1, 1987—January 31, 1988.** Ling, S.C.; Pao, H.P. (Catholic Univ. of America, Washington, DC). [1988]. Contract FG22-86PC90956. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015032/JAW.

The work in this period was mainly focused on the design and construction of the experimental setup as shown schematically in Figure 1. The various components of the cyclone particle-separator have been designed and fabricated in the machine shop. They are now being tested for final adjustment and modification. Some details of the cyclone particle-separator are shown schematically in Figure 2. The piping loop, which includes a horizontal 2-in. PVC pipe and a sloping return pipe, has been purchased and installed. It is ready to be tested together with the cyclone particle-separator.

48102 **(DOE/PC/90958—T5) Study of dense phase cohesive coal transport in plugs: Quarterly report, April--July 1988.** Klinzing, G.E. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). 1988. Contract FG22-86PC90958. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015678/JAW.

The transport loop for the continuous plug flow conveying of cohesive fine coal was installed and operative. It consisted of 40 feet 1 inch steel pipe connected to a pressurized hopper. Three feet

transparent PVC pipe for the viewing section was included in the test loop after every 10 feet section was included in the test loop after every 10 feet section of the steel pipe. Three light probe sensing stations were installed along the pipeline to measure the plug length, plug velocity, and monitor the plug motion. One of the properties of plug flow of cohesive fine coal is that the plug must be longer than the critical plug length. If the instantaneous plug length at any point along the pipeline is shorter the critical plug length, the plug will collapse and be deposited on the bottom of the pipe. To ensure the instantaneous plug length is longer than the critical plug length at any distance along the pipeline, we must begin with an initial plug length longer than the critical plug length of the coal. We found that the minimum initial plug lengths for {minus}200 Mesh (75 micron) of Pittsburgh, Montana, and Virginia coals were 3 feet. Therefore, we decided to study the coal plug flow behavior with initial plug lengths of 3 feet, 4 feet, and 5 feet. Plug flow conveying of cohesive powder can be roughly defined as the conveying of the powder below 1 m/s. If the air velocity is above 1 m/s, dense phase conveying will be observed. Initially, after several attempts, we were unable to transport the coal at velocity of 1 m/s because the steel pipes were too rough. Thus we treated the pipe roughness by blowing the coal at air velocity of 2 m/s. Then, gradually the air velocities were reduced to 1 m/s. To date we are successfully transporting the coal at 1 m/s for distance of 40 feet with initial plug lengths 3, 4, and 5 feet. 4 figs., 2 tabs.

48103 **(PB—88-208715/XAB) Experimental study of a novel jet booster pump. Open File Report (Final), 13 September 1980-31 December 1985.** Wetzel, J.M.; Jackson, T.; Bintz, D.W. (Minnesota Univ., Minneapolis (USA). Dept. of Civil and Mineral Engineering). Dec 1985. 43p. NTIS, PC A03/MF A01.

See also AECTR-6630.

A new form of a low head, jet booster pump was evaluated. The jet pump consisted of a constant-diameter pipe fitted with two wall jets energizing the flow and a constant area diffuser consisting of a slotted-wall portion of the pipe where water and solid fines were withdrawn. The withdrawn water was pressurized and recirculated to the jets by an external centrifugal slurry pump, thus performing a pressure booster operation on the main-line flow. The jet pump was evaluated in a 3-inch-pipe recirculating-flow facility. Extensive tests were conducted with water flow to evaluate and optimize performance characteristics. The best efficiency obtained was about 17%. Addition of solid particles to the flow in sizes up to 3/4 inch resulted in plugging of the screened diffuser for concentrations above about 20% by weight. Coal particles were rapidly eroded to very small sizes due to the action of the high-velocity side jets. Problems associated with the screened diffuser limit the pumps' usefulness.

48104 **(PB—88-213277/XAB) Fire protection in coal-handling facilities (new and retrofit). Technical report.** Dungan, K.W. (Professional Loss Control, Inc., Oak Ridge, TN (USA)). May 1981. 14p. NTIS, PC A03.

As coal becomes an increasingly important fuel source in process industries as well as for the generation of electricity, proper fire protection of coal-handling facilities becomes essential. The problems of spontaneous combustion due to coal-dust accumulation and methane and CO emission are discussed. Protection measures for storage facilities, conveyors, transfer equipment, process equipment, receiving and reclaiming areas are suggested. Control of hazards can be accomplished when clear-cut design objectives are established and proper protection measures provided.

48105 **(SRC—R-833-2-C-85) A study of flow conditions arising in horizontal coarse slurry short distance pipelining practice. Phase I: Sand-slurry tests in a 250 mm pipeline.** Gillies, R.G.; Husband, W.H.W.; Small, M.H. (Saskatchewan Research Council, Saskatoon (Canada)). Sep 1985. 99p. CANMET, 555 Booth St, Ottawa, Ontario, Canada K1A 0G1.

This project was part of a study to develop a suitable predictive method for pipeline transportation of slurries of coarse coal. In this, Phase I of the study, tests were conducted on coarse sand-in-water slurries passing through a 250 mm diameter horizontal pipeline loop. Pressure gradients, concentration profiles, particle velocity distributions and delivered mixture concentrations were determined as functions of slurry flow rate and pipeline in-situ concentration. The results of the tests were applied to improve the two-layer model for flow of slurries in pipelines. 11 refs., 22 figs.

48106 **(SRC—R-833-3-C-86) A study of flow conditions arising in horizontal coarse slurry short distance pipelining practice. Phase II: Coal-slurry tests in a 250 mm pipeline.** Gillies, R.G.; Husband, W.H.W.; Small, M.H. (Saskatchewan Research Council, Saskatoon (Canada)). Aug 1986. 41p. CANMET, 555 Booth St, Ottawa, Ontario, Canada K1A 0G1.

This project was part of a study to develop a suitable predictive method for pipeline transportation of slurries of coarse coal. In this, Phase II of the study, tests were conducted on coarse coal-in-water slurries passing through a 250 mm diameter horizontal pipeline test loop. Pressure gradients, concentration profiles, particle velocity distributions and delivered mixture concentrations were determined as functions of slurry flow rate and pipeline in-situ concentration. The results of the tests were used to develop a new method for predicting the contact load for the two-layer model. 7 refs., 14 figs., 1 tab.

0140 Combustion

REFER ALSO TO CITATION(S) 48064, 48066, 48072, 48075, 48083, 48500, 49192, 49344, 49449

48107 **(AERE-R—13054) Literature survey: combustion related studies in spouted beds.** Gover, M. (UKAEA Harwell Lab. Engineering Science Div.). Mar 1988. 25p. H.M. Stationery Office, London, price Pound 4.00.

This report provides a review of work relating to combustion studies in spouted beds published during the last 30 years. Firstly, it introduces the concept of the spouted bed and describes how it was developed. The report then summarises research undertaken on the subjects of combustion, coal carbonisation, coal pyrolysis, and coal gasification in spouted beds. Most of the papers have been collected through a computer search of the Chemical Abstracts using combinations of the keywords 'spouted bed', 'combustion' and 'coal'.

48108 **(EPRI-CS—5946) Application of pilot-scale coal testing to utility boilers: Final report.** Johnson, T.R.; Sotter, J.G. (Electric Power Research Inst., Palo Alto, CA (USA); Energy and Environmental Research Corp., Irvine, CA (USA)). Jul 1988. 263p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88014902/JAW.

Coal combustion testing at pilot-scale has been used by utilities in an effort to understand the impact of coal characteristics on boiler operations. The value of these tests depends upon the applicability of the pilot-scale results to full-scale boilers. To try and determine this, a survey was conducted of utilities around the world which were known to make use of pilot-scale coal combustion tests, to obtain comparative data on pilot-scale full-scale tests on the same coal. Information was sought on tests covering six aspects of coal behavior which impact on boiler operation, viz: milling, combustion stability and burnout, pollutant formation, ash slagging, fouling and heat transfer, erosion and corrosion, and particulate removal. In general, good qualitative agreement was found between the pilot-scale and the boiler test results, provided reasonable care was taken to simulate the essential features of the combustion process relevant to the aspect of coal behavior of interest. Direct one-to-one applicability was usually not achieved, but suitable scaling was obtained by comparing test coal behavior against known coals. From this survey, several actions which could improve the applicability of pilot-scale tests were identified: Since the test data available from full-scale plant was very limited, more plant measurements should be made under closely controlled conditions to provide good comparisons with pilot-scale tests conducted on the same coals. A wide variety of facility configurations have been used in combustion testing and there is a need for a specialist review of pilot-scale testing to identify suitable scaling techniques and interpretation methods for acceptable similarity with full-scale, and to obtain more of a

consensus view of the most appropriate pilot-scale tests. 50 refs., 57 figs., 9 tabs.

48109 **(ERL—87-71(TR)) Fluidized bed combustion of Devco Prince test rejects.** Anthony, E.J.; Desai, D.L.; Freidrich, F.D. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Feb 1987. 19p. CANMET, 555 Booth St, Ottawa, Ontario, Canada K1A 0G1.

This project was undertaken as part of a study to determine uses for washery rejects from coal cleaning facilities. Several tons of coal reject from Devco Prince coal was prepared from a batch of raw coal cleaned at EPRI's coal cleaning facility near Homer City, Pennsylvania. Although the process produced a reject with similar properties to the parent coal, 11 tests were conducted in an atmospheric fluidized bed combustor to gain some insights into the combustion behaviour of the washery reject. Tests were conducted with and without limestone addition and fly ash recycle. As the reject had only a slightly higher ash content than the parent coal combustion performance was much the same. Further work should be done using rejects with a higher ash content before any conclusions can be made as to the differences between clean coal and coal rejects. 6 refs., 3 figs., 7 tabs.

48110 **(PB—88-204375/XAB) Optics for an instrument to measure the velocity of coal particles in a drop furnace.** Armour, I.A. (Central Electricity Generating Board, Southampton (UK). Technology Planning and Research Div.). Dec 1987. 17p. (TPRD/M—1645/RR87). NTIS, PC E04/MF E04.

This report describes the combustion of pulverized-coal particles in a test furnace in which the burning particles may be observed at various points while being swept through a vertical tube furnace. The report describes the design of an optical system to detect infrared radiation from a cloud of burning coal particles passing a viewing tube. A measure of the time taken by falling particles (and hence their velocity) is obtained by detecting the edge of the cloud at two viewing tubes. The system is designed to work with coal at 500 C but no difficulties should be experienced for coal of higher temperatures.

48111 **(PB—88-206628/XAB) Report on the combustion of Landau smalls in a chain-grate stoker-fired boiler.** Englebrecht, A.D. (National Inst. for Coal Research, Pretoria (South Africa)). 1987. 13p. (COAL—8701). NTIS, PC E04/MF E04.

North American Continent sales only.

Six tests were carried out at nominal loads of 55%, 80%, and 100% of the maximum continuous rating (MCR) of the boiler. (MCR = 3 200 kg/h of dry saturated steam from and at 100 C). The aim of the test work was to determine the optimum thermal efficiency of the boiler and to measure the concentration of particulates in the flue gas emitted to the atmosphere. The test work was carried out at the request of the Transvaal Coal Owners' Association, who provided plus or minus 60 tons of the coal to be tested.

48112 **(PSI—1024/TR-841) Transformations of inorganic coal constituents in combustion systems: Quarterly report No. 7 for the period April--June 1988.** Boni, A.A.; Flagan, R.C.; Helble, J.J.; Peterson, T.W.; Sarofim, A.F.; Srinvasachar, S. (PSI Technology Co., Andover, MA (USA)). Jul 1988. Contract AC22-86PC90751. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88014792/JAW.

The contract approach and description of each task is included in Section 2 of this report. This report represents work accomplished in the 7th quarter of performance on the contract. We specifically highlight work accomplished: at the California Institute of Technology on ash volatilization and aerosol dynamics; at the Massachusetts Institute of Technology on residual ash formation; at the University of Arizona on transformation of mineral matter in a laboratory pulverized coal combustor, and at PSI Technology Company on (1) transformation and adhesion of minerals during combustion in an idealized combustion system, and (2) transformation of pyrite during coal combustion. 22 refs., 42 figs., 6 tabs.

48113 **(SAND—88-8240) Coal Combustion Science: Quarterly progress report, January--March 1988.** Hardesty, D.R. (ed.). (Sandia National Labs., Livermore, CA (USA)). Aug 1988. Contract AC04-76DR00789. 110p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88015369/JAW.

The objective of Task 1: the coal devolatilization task is to characterize the physical and chemical processes which comprise the early devolatilization phase of coal combustion as a function of coal type, heating rate, particle size and temperature, and gas phase temperature and oxidizer concentrations. The objective of Task 2: the coal char combustion task is to characterize the physical and chemical processed involved during coal combustion as a function of coal type, particle size and temperature, and gas phase temperature and oxygen concentration. The objective of Task 3: the fate of mineral matter during coal combustion task is to establish a quantitative understanding of the mechanisms and rate of transformation of mineral matter in coal combustion environments as a function of coal type, particle size and temperature, the initial forms and distribution of mineral species in the unreacted coal, and the local gas temperature and composition. A particular goal is determining the importance of fragmentation in the evolution of the particle size distribution during coal combustion.

48114 **(UP-W—230) Evaluation and testing of Westar Mining Ltd's coal to determine its suitability for coal water mixture combustion, final report.** Parkes, D.M. (Westar Engineering Ltd., Vancouver, British Columbia (Canada)). Aug 1985. 80p. CANMET, 555 Booth St., Ottawa, Ontario, Canada K1A 0G1.

A technical and economic appraisal was undertaken to determine the suitability of Greenhills and Coal Creek coals for use in coal water fuel (CWF) mixtures. AB Carbogel of Sweden carried out bench scale tests of previously washed coal samples. Results were considered somewhat disappointing because of the high ash content, but generally are reported as being suitable for CWF mixtures. English China Clays of England tested the same coals in 1984 but with somewhat better results - lower ash levels, but reduced recovery. The main body of this report presents a comparative view of the results of the two studies, while Appendix 1 presents the Carbogel study, and Appendix 2, the English China Clay study. 6 tabs., 29 figs.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 48150, 48752, 48753

48115 **(NP—8770299) Action Group German Black Coal Mining Zones, Duesseldorf. Report of activities 1986.** (Aktionsgemeinschaft Deutsche Steinkohlenreviere G.m.b.H., Duesseldorf (Germany, F.R.)). 1987. 55p. (In German). NTIS (US Sales Only), PC A04. Order Number DE88770299/JAW.

The report of activities provides an overview of primary energy consumption in the Federal Republic of Germany, the development in black-coal mining, and measures to adapt and improve the economic structure. Total sale of black coal, black coal briquets, and black coal coke of home production went down from 91.9 million tonnes in 1985 to 84.2 million tonnes, i.e. by 7.7 million tonnes or 8.4%. The decrease in sales was due mainly to the steel industry at home and abroad, given the unfavourable conditions in the steel market and given the decrease in specific coke use in blast-furnaces because of higher oil consumption and improved blast-furnace technology. The decrease in this and in other sectors was not compensated by the added use of black coal in the power industry. The publication furthermore contains the balance-sheet and profit-and-loss account for 1986. Photos document mines shut down and their revegetation. (orig./HSCH).

0160 Health And Safety

REFER ALSO TO CITATION(S) 48092, 48104

48116 **(PB—89-213301/XAB) Fire protection of synfuels. Technical report.** Meldrum, D.N.; DiMaio, L.R. (National Foam System, Inc., Lionville, PA (USA)). May 1981. 14p. NTIS, PC A03.

Synfuels by definition are fuels derived from sources other than crude oil that can be used as energy sources in the same manner. Fuels considered include those derived from oil shale, oil sand, coal, alcohols, and mixtures of liquid fuels such as gasohol. Particular attention is devoted to the alcohols. If alcohol is diluted to about 50%, conventional aqueous foams can be used. Highly concentrated and anhydrous alcohols require polar solvent foams for effective fire extinguishment. Gentle application is the watchword. The results of small-scale fire tests of various agents on gasohol are summarized as is the protection of bulk storage of gasohol.

48117 **(PB—88-214309/XAB) Coal-mine bump monitoring. Open File Report (Final), October 1984-November 1985.** Descour, J.M.; Miller, R.J. (Colorado School of Mines, Golden (USA). Earth Mechanics Inst.). Dec 1987. 112p. NTIS, PC A06/MF A01.

Monitoring of microseismic activity was maintained during several major phases of retreat mining in the 9 Right section of Olga Portal 2 coal mine in Caretta, West Virginia. Significant observations were made regarding mining, stress indications, stability problems, and microseismic event occurrence. The first part of the analysis of microseismic data was focused on recognition of parameters and mechanics of an individual microseismic source as an element of instability development. Results of this analysis should also be useful for the development of a real-time microseismic data acquisition and processing system. The second part of the analysis was oriented to determine the correlation between areal and temporal event distribution, mining situation, and geological parameters to improve the reliability of a bump forecasting technique.

48118 **Quantitative comparison of regional distributions of inhaled Tc-99m DTPA aerosol and Kr-81m gas in coal miners' lungs.** Susskind, H.; Brill, A.B.; Harold, W.H. (Brookhaven National Lab., Upton, NY (USA)). *American Journal of Physiologic Imaging;* 1: No. 2, 67-76(1986).

Regional distributions of deposited Tc-99m diethylenetriamine pentaacetate aerosol (DPTA) and of Kr-81m were compared in the upright lungs of 22 coal miners with nonembolic pulmonary disease. Pixel-by-pixel distributions of Kr-81m and DPTA corrected for lung volume, as well as DTPA/Kr-81m ratios, were determined by computer analysis in each lung and plotted against lung position. DTPA was preferentially deposited in the basal regions of 36/44 lungs. In the same lungs, Kr-81m was preferentially distributed in the apical regions of 18 lungs, bilaterally in six subjects. Similar DTPA and Kr-81m regional distributions throughout both lungs were obtained in only 11 (50%) subjects. No significant correlations were found between regional particle deposition and pulmonary function measurements. The effects of gravity-related lung pressure gradients and ventilation-related particle residence time on the deposition of DTPA may limit its usefulness when quantitative information is required to evaluate subtle changes in ventilation in nonembolic pulmonary patients and for basic studies of ventilation and perfusion.

02 PETROLEUM

48119 (CAPPA—8803, pp 14) **Electronic data interchange in the oil and gas industry.** Jonsson, D. (GE Information Services Canada). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canads T2E 2P8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

Electronic data interchange (E.D.I.) is the transmission of business documents between companies electronically. This requires the standardization of both format and content of the documents. As few industries pass more paper documentation than oil and gas companies, EDI is growing quickly and provides the opportunity for substantial savings. EDI is not a computer application to speed up the mail. Rather, it is a different way of doing business which requires commitment and long term vision from the participants. 2 tabs.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 48127, 48134

48120 **(AU/G—1982) Investigation of the relations between formation fluid dynamics and petroleum occurrences, Taber Area, Alberta. First progress report, July 1, 1981-September 30, 1982.** Toth, J.; Corbet, T. (Alberta Univ., Edmonton (Canada). Dept. of Geology). 1982. 60p. (CE—01682). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes the progress into examining the relation between oil occurrences and hydrogeology in the Taber area of Alberta. A study of the area's regional stratigraphy and historical geology is presented to serve as a basis for the definition of the hydrostratigraphy which is germane to the intended flow studies. A knowledge of the historical geology and in particular of the paleotopography during extended periods of subaerial erosion will be required for the analysis of transient flow conditions. Hydrostratigraphy is the 3-dimensional distribution of the fluid-conducting and fluid-retaining geologic formations. It serves as a basis for one of this project's main objectives: the evaluation of the regional flow systems. A first approximation of hydrostratigraphic division of the area has been completed and is represented by the hydrostratigraphic column and hydrostratigraphic cross sections included in this report. Structure contour maps show the relief and areal extent of the hydrostratigraphic units. Also included in this report are summaries of two reports on basin analysis presented to an American Association of Petroleum Geologists research conference in Tucson, Arizona in 1983. 14 figs., 1 tab.

48121 **(OCS/EIS/EA/MMS—88-0044) Gulf of Mexico sales 118 and 122: Central and Western planning areas: Final environmental impact statement.** (Minerals Management Service, New Orleans, LA (USA). Gulf of Mexico OCS Regional Office). Aug 1988. 547p. Unlimited audience, publicly available. Minerals Management Service, Washington, DC 20240.. Order Number TI88015713/JAW.

The proposed action for Sale 118 (March 1989) will offer for lease all unleased acreage in the Central Planning Area (CPA), which amounts to approximately 33.5 million acres or 6,265 blocks as of December 1987 (Figure I-1). This area is located from 3-200 miles offshore in water depths ranging from 4m to 3425m. The proposed action for Sale 122 (August 1988) will offer for lease all unleased acreage in the Western Planning Area(WPA) with the exception of areas deferred at the 5-year program stage described below. The unleased are available for leasing amounts to approximately 27.9 million acres or 5,080 blocks as of January 1988 (Figure I-1). This area is located from 9-222 miles offshore in water depths ranging from 8 m to over 3, 000 m. Excluded from the proposal are Blocks A-375 (East Flower Garden Bank) and A-398 (West Flower Garden Bank) in High Island Area, East Addition, South Extension. The biological, archaeological resources, and military areas stipulations are being considered for adoption as mitigating measures for Sales 118 and 122. The proposed actions are discussed as Alternative A in Sections II and IV of this EIS. The proposed Sale areas and deferrals are shown in Figure I-1. Depiction of areas under lease as of December 1987 are shown on Visual No. 1, Historic Leasing. Basic assumptions, estimates, and development scenarios for impact analysis of the proposed actions are presented in Section IV.A. The development scenarios for each proposed action provide a quantitative and locational framework for the proposed sales alternatives and are also used along with other impact producing factors in the cumulative analyses (Section IV.D). High Find Scenarios were also used in supplemental analyses for comparative purposes (Section IV.D). Table-S-1 provides resource and offshore infrastructure estimates for the M Scenario. 314 refs, 9 figs, 38 tabs.

48122 **(PB—88-208616/XAB) Beaufort Sea: information update.** Becker, P.R. (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Apr 1988. 97p. NTIS, PC A05/MF A01.

See also PB—87-195145.

The report is based on a multi-disciplinary meeting held March 6-7, 1985, as part of preparations for the Beaufort Sea Sale 97. The chapters are based on presentations given: The causeway effect: Modification of nearshore thermal regime resulting from causeways; Summertime sea ice intrusions in the Chukchi Sea; The deepwater limit of ice gouging on the Beaufort Sea shelf; Distribution, abundance, migration, harvest, and stock identity of Belukha Whales in the Beaufort Sea; Ringed seals in the Beaufort Sea; Beaufort Sea socioeconomics; The Baffin Island Oil Spill, (BIOS) Project.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 48134, 50291, 50292, 50293

48123 (CAPPA—8803, pp 17) **The production injection disposition (PID) system.** Jenkinson, G. (Energy Resources Conservation Board). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; #35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

The Energy Resources Conservation Board (ERCB) is in the process of designing a new computer based system of processing production, injection and disposition related data. As a result, the familiar inputs to the system will be changing. This paper takes a high-level look at the changes which the reporting operator and the end user of this data see, and explores the philosophy and reasoning behind some of the changes. The changing of any system always involves some planning for the actual changeover. This paper also defines the events which must be undertaken jointly between the oil industry and the ERCB in order to accomplish a successful implementation. 4 figs.

48124 (CAPPA—8803, pp 5) **Data exchange between the regulators.** Keller, R.A. (Energy Resources Conservation Board). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

It is necessary to have more and more accurate information to manage a company in an efficient and professional manner. This article discusses the data collection, dissemination and distribution (that is, data management) with reference to production data from the petroleum industry. Briefly outlined are the efficient methods of data storage and accuracy, thus improving verification with the goal of improving overall data management.

0204 Processing

REFER ALSO TO CITATION(S) 48039, 48042, 48044, 48166, 49191

48125 **(PB—88-212253/XAB) Regenerative flue-gas desulfurization in European oil refineries - cost estimates based on a European application.** Ellis, R.J.; Fandino, C.G.; Ferri, P.; Fritsch, W.; Sutherland, H. (Concawe, The Hague (Netherlands)). Mar 1988. 26p. (CONCAWE—3/88). NTIS, PC E03/MF A01.

The petroleum refinery at Schwechat, Austria commissioned in 1985 a Wellman-Lord regenerative flue-gas desulfurization plant (FGD) to control emissions essentially from the power-generating sector of the refinery. This experience is used to estimate costs of Wellman-Lord FGD which would be more representative for other European refineries. Costs are given for the Schwechat-size FGD (600,000 N cubic meters/h flue gas) and a typical refinery-size FGD (150,000 N cubic meters/h flue gas). It is concluded that FGD cost-effectiveness is better when refineries burn higher-sulfur fuels but small plant size has a significant detrimental effect. Wellman-Lord FGD can more than double the cost of liquid refinery fuel.

48126 **(PB—88-213285/XAB) Loss prevention and fire protection for oil refineries. Technical report.** Lockwood, N.R. (Mobil Research and Development Corp., Princeton, NJ (USA)). Apr 1981. 14p. NTIS, PC A03.

The handling of large volumes of volatile, toxic, and flammable liquids at high pressures and high temperatures requires special fire protection to reduce fire risk. Fire water systems, fixed water-spray systems, monitors and hose reels, drainage, portable fire extinguishers, process safety and fire protection, control buildings, offsites, storage tank fire protection, fire trucks, utilities and training are methods of fire protection and loss prevention discussed to protect today's sophisticated, expensive oil refineries in the most cost-effective way. These methods are described and discussed individually.

48127 **(UCID—21303-88-2) Petroleum geochemistry project: Quarterly report April-June 1988.** Braun, R.L.; Burnham, A.K.; Sweeney, J.J. (Lawrence Livermore National Lab., CA (USA)). Jul 1988. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015406/JAW.

The objective of this work is to develop and test chemical kinetic models of oil generation and expulsion. The work has several components: experiments to understand the mechanisms and kinetics of oil generation, development of computer programs for analyzing experiments and applying chemical kinetics and thermodynamics in a geological environment, and comparing predictions of chemical/geological models to field data. Some aspects of this work are part of a joint research project with INTEVEP, S.A., in which model predictions will be tested in the Maracaibo Basin. Other aspects are being done with partial support from an industrial sponsorship program. Following the executive summary, contents of this report include: thermal cracking of hydrocarbons; equation-of-state improvements in chemical kinetics code PYROL; pyrolysis kinetics of Argonne premium coal samples; chemical analysis of pyrolysates; impact of kerogen structure on oil generation rate; modeling vitrinite reflectance data; and preliminary use of thermal history data of the Maracaibo Basin. 12 refs., 11 figs., 4 tabs.

0205 Products And By-products

REFER ALSO TO CITATION(S) 48045, 48493, 48935, 48943, 48944

48128 **(AD-A—192536/1/XAB) Study relating to the fog oil replacement program. Interim report.** Wimer, W.W.; Wright, B.R.; Kanakia, M.D. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Dec 1987. 41p. (BFLRF—241). NTIS, PC A03/MF A01.

The U.S. Army has made a commitment to replace smoke generator fog oil with diesel fuel and/or JP-8. This report discusses the work done to help solve this existing fog-oil substitution problem. Areas of research included: (a) modification of diesel fuel and JP-8 by removal of their lower boiling fractions. (b) design, construction, and development of a bench test for measuring obscuration. (c) running a computer-simulation program to assist in evaluating the engineering feasibility of designing, developing, and constructing a compact unit capable of fractionating diesel fuel and/or JP-8 should this be desired. (d) conducting a literature search to identify methods and/or compact equipment capable of fractionating diesel fuel and JP-8 to higher average molecular weight fractions. (e) production of test samples. (f) chemical analyses and obscurant evaluations.

48129 **(AD-A—193452/0/XAB) Managing fuel quality in the Department of Defense. Final report.** Salthouse, R.W.; Hoyler, M. (Logistics Management Inst., Bethesda, MD (USA)). Jun 1987. 81p. (LMI-AL—619R1). NTIS, PC A05/MF A01.

Fuel-quality problems can have serious consequences on DoD's mission. Poor-quality fuel can degrade weapons systems performance and damage critical weapons components. Avoiding such problems is the responsibility of DoD fuel managers. It was found that current quality control procedures detect and avoid almost all

fuel-quality problems before the fuel is used. DoD has experienced relatively few documented fuel problems that cause inadequate performance of DoD weapons systems. Of the few fuel-quality problems that exist, the most common is diesel fuel deterioration during long-term storage. War-reserve stocks in remote overseas locations, particularly those with hot climates, are most susceptible. The rapid turnover of diesel-fuel stocks generally avoids deterioration in the United States. Strategies to improve fuel-quality management should, therefore, focus on diesel-fuels in long-term storage. The authors offer recommendations to the Defense Logistics Agency. For a more-lasting solution to diesel fuel deterioration, the authors suggest that the Service fuels-research offices continue to investigate the use of additives for increasing stability. The research offices should also develop a new, more-reliable diesel-fuel stability test. The current test is ineffective in screening fuels likely to deteriorate.

0206 Health And Safety

REFER ALSO TO CITATION(S) 48141, 49492

48130 **(PB—88-216783/XAB) Accidents associated with oil and gas operations: Outer Continental Shelf, 1956-1986.** Tracey, L. (Minerals Management Service, Vienna, VA (USA). Office of Offshore Information and Publications). Mar 1988. 254p. (OCS/MMS—88/0011). NTIS, PC A12/MF A01.

Accidents associated with the development of oil and gas resources underlying the outer continental shelf during the 1956-1986 period are assessed. Accidents involving collisions of vessels and platforms have been excluded. This report contains tables of classifications of accidents associated with oil and gas operations by region and type. Regions segregated for the study include the Gulf of Mexico, Pacific region, Alaskan region, and Atlantic region. In addition, the report includes graphs of data pertaining to accidents resulting in crude and condensate spills.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 48150, 48753, 50295

48131 **(DOE/EI/20477—T1) New Jersey No. 2 heating oil prices and bulk terminal stocks monitoring program, 1987--1988 heating season: Final report.** Rizzolo, D.R. (New Jersey Dept. of Commerce and Economic Development, Newark (USA). Div. of Energy Planning and Conservation). 1988. Contract FC01-87EI20477. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014716/JAW.

In accordance with the Grant for Reimbursement from the United States Department of Energy to the State of New Jersey, the New Jersey Department of Commerce, Energy and Economic Development, Division of Energy Planning and Conservation (subsequently referred to as the Division) has continue an expanded program to monitor retail and wholesale prices, and bulk terminal stocks of No. 2 heating oil within the state. The terms of the grant specified that price and stock surveys of No. 2 heating oil be conducted on a semi-monthly basis to obtain the necessary data from fuel merchants and bulk terminal operators identified by the United States Department of Energy. The terms of the grant specified that additional retail price surveys be conducted on a weekly basis from the last Monday in November to the first Monday in March. Summary reports were to be prepared as of specified reference dates and submitted to the United States Department of Energy within four working days of those dates. 6 figs.

48132 **(DOE/EIA—0380(88/O5)) Petroleum marketing monthly, May 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 29 Jul 1988. 164p. NTIS, PC A08/MF A01 - GPO; 1; GPO Dep. Order Number DE88015245/JAW.

Worldwide crude oil prices generally were flat in May, following a slight dropoff after the Organization of Petroleum Exporting Countries (OPEC) meeting in late April. Continued firmness in product markets kept refining margins at profitable levels, encouraging high refinery runs. Gasoline production in the United States has been low this year, partly due to refinery maintenance problems and partly due to the requirement to extract higher octane unleaded gasoline from crude oil. However, high refinery output of non-gasoline products is expected to result in early building of fuel oil stocks. In the United States, the composite refiner acquisition cost of crude oil rose 41 cents in May to $16.22 per barrel, an increase of 2.6 percent. Despite a slight increase in motor gasoline sales, the continued seasonal decline in fuel oil sales resulted in a reduction of 2.3 percent compared to April in total refiner sales of the top ten petroleum products. 12 figs., 53 tabs.

48133 **(IEE-SR—196) Synopsis of non-OPEC developing countries.** (Institute of Energy Economics, Tokyo (Japan)). 20 Dec 1987. 205p. (In Japanese). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88753447/JAW.

This report outlines the energy situation of non-OPEC developing countries mainly on the trend of crude oil development, production, and export. For 5 countries (excluding Malaysia) of Mexico, Colombia, Egypt, North-Yemen, and Oman, the reality of historical procedure, international environment, or mine developing activities are described. Oil consumption of these countries is growing as well as exploration and development. Among the non-OPEC developing countries, Mexico is at top of reserve and the production and is developing remarkably. In 5 years from 1975, the oil production reached the 4th position in the world. Colombia turned out to be an oil producing country since 1986. Egypt increased its oil production, in ten years to 1985, as much as 4 times to almost one million barrels a day. Oman is an oil exporting country since 1987. North Yemen had some trouble, but is better since 1987. (16 figs, 60 tabs)

48134 **(OCS/MMS—88-0010) Federal offshore statistics, 1986: Leasing, exploration, production, and revenues.** Harris, W.M. (comp.). (Minerals Management Service, Vienna, VA (USA). Office of Offshore Information and Publications). 1988. 95p. Minerals Management Service/Mail Stop 642, 1951 Kidwell Drive, Vienna, VA 22180. Order Number TI88014881/JAW.

This fifth volume of offshore statistics reports the mineral leasing, exploration, and production activities on the submerged lands and seabeds of the Nation's Outer Continental Shelf (OCS), as of December 31, 1986. As did its predecessors, this volume also reports selected state offshore statistics that are provided by the coastal states. It should be noted that certain tables throughout this 1986 volume show major/or minor corrections of previously reported data. These result from internal audits and recapitulations made of all OCS lease sales from 1954 forward. Such corrected figures are taken from recently published OCS Statistical Summaries and supersede differing figures that may have been published earlier by the Minerals Management Service (MSS). Inquiries about these adjustments may be addressed to the MSS through the Regional Director, Gulf of Mexico OCS Regional Office, Minerals Management Service, 1201 Elmwood Park Boulevard, New Orleans, Louisiana 70123-2394. Also, in keeping with standard accounting practice, parentheses are used to enclose negative numbers not added in a given column. This is also done wherever subtractive adjustments are expressed in any statistical information totaled in the 67 tables of this report. In the next, or sixth volume, the MSS will again tabulate all available offshore statistics. Until the 1987 volume is released, some post-1986 data may be obtained in draft form by contacting the MSS Office of Offshore Information and Publications (OIP) in Vienna, Virginia. Comments and corrections should be addressed to Editor, Offshore Statistics in OIP. 67 tabs.

48135 **(P—300-88-001) Quarterly oil report: Third quarter, 1987.** (California Energy Resources Conservation and Development Commission, Sacramento (USA). Fossil Fuels Planning Office). Jan 1988. 53p. Unlimited audience, publicly available. California Energy Commission, 1516 Ninth Street MS 13, Sacramento, CA 95814. Order Number TI88014873/JAW.

The volumes of petroleum fuels supplied to California in the fourth quarter of 1987 increased 1.6 percent from year ago levels. The increase is the result of increased unleaded gasoline and residual fuel oil use. Other fourth quarter results show that all product

imports remained higher than year ago levels, but most were below the previous quarter except unleaded gasoline. Unleaded gasoline imports were higher, exports were reduced and stocks drawn down in the fourth quarter compared to the previous quarter to meet increased demand for unleaded fuel. Demand for low sulfur fuel oil increased toward the end of the quarter because natural gas sales to electric utilities were curtailed.

48136 **(RA—TP3140) Canadian diesel locomotive fuel in the eighties.** Maughan, R.G. (Railway Association of Canada, Canadian Pacific Ltd., Montreal, Quebec). Jun 1981. 96p. (CE—01683). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A review was made of information concerning the future availability of Canadian supplies of diesel fuels for railway locomotives. Relevant literature was reviewed, and meetings were held with the five Canadian suppliers of railway diesel fuel. Also, the study team visited the Southwest Research Institute in San Antonio, Texas to ascertain the status of their program of investigation into alternate fuels for medium speed diesel engines. Major conclusions were as follows. There will be sufficient quantities of current-quality diesel fuel available to Canadian railways for the next 2-3 years, barring major interruptions. In the longer term, however, important fuel properties will change, principally cetane number, cloud point and distillation endpoint. Canadian railways can cope with the changes in fuel properties likely to occur over the next 5-10 years without significant losses in operating effectiveness. Implementation of a planned Western refinery expansion program is of critical importance in ensuring supply and quality. None of the potential alternate on-board fuels, e.g. gases and alcohols, constitutes a technically viable option to off-specification diesel fuel at this time. The use of hot-wells, flow improvers, heated fuel delivery cars and fuel lines may be necessary to accomodate changes in diesel fuels. Future tar sand and heavy oil projects may offer a potential for acquiring additional low quality diesel fractions. 4 figs., 6 tabs.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 48121, 48125, 48921, 49577, 49582, 49583

48137 **(PB—88-211768/XAB) Great Ohio River oil spill of 1988: a case study.** Clark, R.M.; Vicory, A.H.; Goodrich, J.A. (Environmental Protection Agency, Cincinnati, OH (USA). Water Engineering Research Lab.). May 1988. 19p. (EPA—600/D-88/094). NTIS, PC A03/MF A01.

A recent massive spill of diesel oil on the Monongahela River provided a very real example of the vulnerability of drinking-water utilities to upstream industrial spills and discharges. Nearly eight hundred thousand gallons of diesel fuel entered the Monongahela River, 25 miles upstream from Pittsburgh and eventually affected the water supply of 3 1/2 million people on the Ohio River. Fortunately the institutions for dissemination of information and for monitoring the spill were effective and very few hardships occurred. However, the spill did reinforce the need for better techniques for predicting spill movement and concentrations on the Ohio.

0210 Legislation And Regulation

48138 (CAPPA—8803, pp 10) **Data exchange between the regulators: Alberta Energy's role.** Slinn, P. (Alberta Energy, Canada). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

Alberta Energy in its role as one of the three principal regulators of the oil and gas industry in the province collects, uses and shares an extensive amount of data. A large integrated computer system was developed to maximize the use of data available to the department. Whenever possible, Alberta Enery will obtain needed data from other regulators before approaching industry. Further work is underway to improve the exchange of data process amongst the three principal energy industry regulators. The purpose of this paper is to describe briefly how Alberta Energy uses data for oil and gas revenue administration, where it comes from and who receives data, and to outline present and continuing efforts to share data with the other regulators. 3 figs.

48139 (CAPPA—8803, pp 10) **Information exchange with the Alberta Petroleum Marketing Commission.** Tovell, R.W. (Alberta Petroleum Marketing Commission). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

This paper briefly outlines who the Alberta Petroleum Marketing Commission exchanges information with in order for the APMC to carry out their business functions and, more specifically, their regulatory functions. In addition, the paper discusses several areas where the APMC is trying to improve the effectiveness of the information exchange process. This paper also provides a short review of the Alberta government's new Standing Committee on Oil and Gas Reporting.

0230 Properties

REFER ALSO TO CITATION(S) 48127

48140 **(AD-A—192261/6/XAB) Petroleum Quality Information System (PQIS): requirements and recommended design. Final report.** Arnberg, R.L. (Logistics Management Inst., Bethesda, MD (USA)). Dec 1987. 108p. (LMI-AL—628R1). NTIS, PC A06/MF A01.

DoD uses about 200 million barrels of petroleum fuels a year, at annual cost of more than $6 billion. To make sure the various fuels are suitable for their intended uses, standards of quality have been established. But data about quality are not always current or in a form that lends itself readily to analysis. A suitable DoD-wide system for collecting and analyzing data about fuel quality is possible. Much of the work would be done by computers now used by the Military Departments and Defense Fuel Supply Center (DFSC) for bulk fuels purchased and kept in dormant storage. These are most subject to degradation and contamination by water and impurities. The system would be expanded to include quality-control data for all bulk petroleum purchases. Also recommend is collecting data using decentralized microcomputers; transferring data to a DFSC minicomputer for storage, retrieval, and report generation; and moving data to a computer mainframe when statistical analysis is needed. The task of entering data should be delegated to the petroleum quality organizations of the various Departments, by product type: JP4 for the Air Force, JP5 and F76 for the Navy, and ground fuels for the Army.

0240 Storage

48141 **(PB—88-213343/XAB) New developments in bulk storage of flammable liquids. Technical report.** Johnson, D.M. (Standard Oil Co. of California, San Francisco (USA)). Nov 1980. 10p. NTIS, PC A02.

New regulations by the Environmental Protection Agency require that changes be made in the construction of flammable liquid-storage tanks and their appurtenances. Among these are a double-seal system for external floating roofs, a seal between tank-wall internal floating cover, and a recovery or disposal system for vapor. Lightning protection and drainage and impounding of spills are required. Safe storage practices are highlighted.

0250 Combustion

REFER ALSO TO CITATION(S) 48871, 49492

48142 (AD-A—193831/5/XAB) Diesel combustion fundamentals. Phase 1, Volume 1. Technical report. Final report. Johnson, R.T. (Missouri Univ., Rolla (USA). Dept. of Mechanical and Aerospace Engineering). Jul 1987. 171p. NTIS, PC A08/MF A01.

The general goal of the project was to operate the Cooperative Fuel Research engine for rating diesel fuels (cetane engine) at conditions more representative of modern diesel engines and determine if results could be obtained that would better predict fuel behavior in modern engines. This goal was pursued by installing extensive instrumentation and data-acquisition facilities on a cetane engine and evaluating the performance, emissions, and combustion characteristics of ten different diesel fuels that had a wide range of different properties. After substantial experimental investigation, operating conditions for the cetane engine were established using an engine speed of 1200 rpm and a compression ratio of 20:1. The engine speed was sufficient to eliminate data-reproducibility problems encountered at the standard cetane rating speed of 900 rpm. The 20:1 compression ratio was selected as a compromise between nominal values for DI and IDI engines. Detailed test, operation, and maintenance procedures were established to provide consistent results from the cetane engine.

48143 (EPRI-AP—5937) 1987 fuel oil utilization workshop: Proceedings. Sanders, C.F.; McDonald, B.L. (Electric Power Research Inst., Palo Alto, CA (USA); Energy Systems Associates, Tustin, CA (USA)). Jul 1988. 299p. (CONF-8710362—). Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015232/JAW.

From Fuel oil utilization workshop; Boston, MA, USA (21 Oct 1987).

A workshop to consider current problems related to fuel oil utilization was held in Boston, Massachusetts, on October 21-22, 1987. The primary objective of the meetings with 64 participants was the interchange of information related to fuel oil projects conducted by some of the utilities, EPRI, EPRI contractors, and others. Through the interactions, EPRI gained useful insight into directions for continuing and future studies and utility support efforts. The presentations and discussions addressed fuels and combustion related problems encountered in utility boiler systems burning residual fuel oils as the primary fuel. Included were the results of fundamental studies, plant tests and demonstrations, and operating experiences. Among the major presentation topics covered were combustion and spray characteristics of residual oils, utility boiler emulsion economics, combustion tests using both low gravity API and high asphaltene residual oils, results of an actual fuel oil evaluation study in Florida, stability and compatibility predictions of residual fuel oils, ASTM activities related to heavy fuel oils, the relationship of fuel quality to particulate emissions from residual oil-fired boilers, and a status report on the EPRI Residual Fuel Handbook. Four discussion group meetings were held: the subjects including technology development, operating problems and methods, fuel supply, and atomization. The respective chairs of each discussion group presented a summary to the workshop attendees. Papers have been entered individually into EDB and ERA.

03 NATURAL GAS

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 48121, 48134

48144 (DOE/MC/21132—2560) Deep gas in the Barbados accretionary prism: Sources, migration, detection: Final report. Speed, R.C. (Northwestern Univ., Evanston, IL (USA). Dept. of Geological Sciences). Jun 1987. Contract AC21-84MC21132. 153p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE88001060/JAW.

The project objectives are: (1) to detect the existence on Barbados of gas derived from underthrust or underplated sediments at the prism base (now at 20 to 25 km in depth); (2) to understand the conditions and processes of organic maturation within and below the accretionary prism and the evolution of migration plants and reservoirs for gas within this progressively deforming mass; (3) to consider further strategies and methodologies by which gases generated at deep and shallow depths may be discriminated; (4) to study processes of accretion and structure generated in an active intra-oceanic subduction zone (Lesser Antilles) with large influx of terrigenous sediments; and (5) to provide a modern analog for the structural and hydrocarbon evolution of ancient Cordilleran accretionary complexes that incorporate an abundance of terrigenous sediment. Contents of this report include: forearcs and hydrocarbons; forearcs in global context, Lesser Antilles forearc; geologic evolution of Barbados; organic and hydrocarbon contents; thermal; deformation and structures; fluid emission; applications to ancient US prisms; and conclusions.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 48134, 50291

0304 Products And By-products

REFER ALSO TO CITATION(S) 48357

0305 Health And Safety

REFER ALSO TO CITATION(S) 48130

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 48134, 48163, 48758, 48763, 48784, 48872, 49062, 50295

48145 (CAPPA—8803, pp 10) Optimization of gas sales. McKendrick-McNabb, A. (Dome Petroleum Ltd., Canada). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

The objective of this paper is to define the benefits of descision support systems for optimizing gas sales and maximizing profits. In a deregulated gas market, the gas business is more complex not only for the gas marketer, but also for the operator. The paper focuses on two examples of decision support systems. The first, Gas Field Optimization Model, assists operations in developing optimum well flow plans that meet gas contract nominations. The second, SASGAS, Supply Allocation System for Gas, generates plans for the shipment of industrial or direct gas sales from over 60 Alberta plants to purchasers anywhere in North America. These systems have resulted in improved cashflow and profitability and have provided strategic advantages in a very competitive market. 3 figs.

48146 (CAPPA—8803, pp 9) Natural gas royalty: the resource owner draws the line. Varley, W.R. (Alberta Department of Energy). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

An overview of the circumstances and events that precipitated the announcement by the Government of changes to the Natural Gas Royalty regime and accompanying administration, effective January 1, 1988 is provided. The identification and explanation of the issues and concerns that the changes to the Natural Gas Royalty regime address, such as the price drop in gas, are discussed, recognizing that these concerns are from the perspective of the resource owner. The relationship of those issues of the resource owner and the concerns and issues expressed by the producer are detailed. A review of the process employed by the Government to resolve the issues, including the interaction of the industry associations in the process, is included. The results of industry/govern-

ment discussions and how the action steps address the needs of the resource owner in an environment of natural gas deregulation are provided. The introduction of the concepts of Average Market Price, 80% of Average Market Price as a minimum valuation and the use of a Corporate Average Price are explained. 5 figs., 2 tabs.

48147 (CAPPA—8803, pp 18) **Natural gas royalty: the resource owner draws the line.** Knight, D.K. (D&S Petroleum Consulting Group Ltd.). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2F 2P8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

In the spring of 1987, the Alberta Department of Energy initiated a comprehensive review of its natural gas and byproducts royalty system. The Government stated its concern that the existing structure of the gas royalty system was not appropriate in an environment of market pricing, in part because of its complexity. Industry associations were requested to submit proposals to revise the existing royalty system ensuring certain characteristics: certainty of royalty liability (both volumes and blue), modest cost of compliance and administration for both industry and the government and the acceptability of all parties of a reasonable and fair return to the Province for its resources. This paper highlights the Independent Petroleum Association of Canada's points of view about the recent changes and proposed changes to the natural gas royalty regime in Alberta. Presented are: IPAC's recommendations with respect to royalty structure, administration and incentives, as well as IPAC's concerns relating to the 80% of average market price minimum royalty and corporate average price.

48148 (CAPPA—8803, pp 12) **Panel discussion on natural gas royalty: the resource owner draws the line.** Fisher, L.J. (Canadian Petroleum Assoc.; Esso Resources Canada Ltd.). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E EP8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

The Canadian Petroleum Association believes that royalty systems based on sound principles and reflecting a longer term view of energy markets will maximize the benefits to Canada from development of our resources. In principle gas royalties should be levied at a flat rate, irrespective of price, age of the reservoir or company size. The only exception would be to provide relief, as needed, to avoid the premature abandonment of marginal wells. Such a system would also achieve the very important objective of being simple to administer. The current royalty systems in Alberta and B.C. are inconsistent in many ways with sound principles and have become very expensive to administer for both the producer and the Crown. Both Alberta and B.C. are now reviewing their royalty systems to address these conserns. Recent changes announced by Alberta fall short of the needed reforms and in some cases are inconsistant with the deregulated market. Changes proposed by the B.C. government, on the other hand, represent genuine progress towards reform. Both governments have consulted extensively with the industry in their respective royalty reviews.

48149 **(CI—8308) Attitude study on gaseous fuels.** (Compusave, Inc., Ottawa, Ontario (Canada)). Aug 1983. 145p. (CE—01735). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Compusave Inc. was engaged by Consumer and Corporate Affairs Canada to conduct a large-scale national survey on gaseous fuels, especially propane and compressed natural gas (CNG). The objective of the Attitude Study on Gaseous Fuels was to measure the awareness of propane and CNG as alternative fuels to gasoline among commercial vehicle operators, to identify their attitudes towards the fuels, and to measure their intention to convert. A national survey was developed to empirically determine the attitudes of those firms who had already converted to an alternative fuel as well as those firms who had not converted. The aspects of fuel conversion covered by the survey included barriers and advantages to conversion, the vehicle grant program, safety factors and the supply of information about fuel conversion. Results with analysis of each question are provided in the order the questions appeared. Where possible, the analysis compares the major dependent variables of converted/non-converted and province. 68 tabs.

48150 **(EPRI-P—5993) Proceedings: 1987 fuel supply seminar.** Prast, W.G. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA); Atlantis, Inc., Green's Farms, CT (USA)). Aug 1988. 307p. Unlimited audience, publicly available. Research Reports Center, Box 50490 Palo Alto, CA 94303. Order Number TI88015400/JAW.

The seventh annual EPRI Fuel Supply Seminar was held in Baltimore, Maryland, from October 6 to 8, 1987. The major emphasis of the meeting was on identifying fuel market risks and planning concerns in order to cope with inherent uncertainties and make informed fuel supply decisions. Sessions dealt with the natural gas markets including the prospects for continued availability of gas as a boiler fuel, the relationship of gas and oil prices and the relevance of different regulatory issues. Other sessions addressed the political dimensions of world oil supply and the role of oil inventories in price dynamics, the interaction of world trade cycles, interest rates and currency fluctuations on utility fuel planning, and the role of strategic fuel planning in various utilities. The changing coal transportation market was the subject of several presentations, concluding with a review of utility experiences in integrating coal transportation and coal supply procurement. Presentations were made by various specialists including EPRI research contractors reporting on the results of ongoing research, speakers drawn from the utility, coal and natural gas industries, and independent consultants. The principal purpose of the seminar continues to be to provide utility fuel planners and fuel procurement managers with data and insights into the structure, operations and uncertainties of the fuel markets, thereby supporting their development of flexible fuel strategies and contributing to integrated utility decision making. Selected papers have been processed separately for inclusion in the energy data base.

48151 **(GRI—88/0020) Competitive position of natural gas: Industrial frying.** Minsker, B.S.; Salama, S.Y. (Gas Research Inst., Chicago, IL (USA)). Jan 1988. 52p. Unlimited audience, publicly available. Gas Research Institute, 8600 West Bryn Mawr Ave., Chicago, IL 60631. Order Number TI88014945/JAW.

This study provides insights into the important technological and economic factors influencing the future competitiveness of natural gas-fueled frying technologies. The report focuses on the performance factors influencing the fuel and frying equipment selection process. It relates these performance factors to the capabilities of existing gas-fired frying equipment and to the requirements likely to be placed on new gas technologies. Industrial frying consumed over 12 trillion Btu in 1985. Natural gas accounted for 93 percent of this total, while distillate oil represented five percent and electricity represented another two percent. Most of the oil-fired fryers are generally used only in areas such as the Pacific Northwest where electricity is relatively inexpensive. The immersion tube fryer, in which combustion gases are passed through tubes in the frying oil, is the most common type of fryer in use. The heat exchanger fryer, in which the frying oil is heated externally before being circulated back to the kettle, is more efficient; however, it is also more expensive and thus not used to a large extent. The bottom-fired fryer is the least efficient of the three designs and is the least common. 22 refs.

48152 **(GRI—88/0042) Competitive position of natural gas: Industrial baking.** Minsker, B.S.; Salama, S.Y. (Gas Research Inst., Chicago, IL (USA); Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Jan 1988. 66p. Unlimited audience, publicly available. Gas Research Institute, 8600 West Bryn Mawr, Chicago, IL 60631. Order Number TI88014944/JAW.

Industrial baking is one of the largest natural gas consumers in the food industry. In 1985, bread, rolls, cookies, and crackers accounted for over 82 percent of all baked goods production. Bread accounting for 46 percent of all production. The baking industry consumed approximately 16 trillion Btu in 1985. About 93 percent was natural gas, while distillate fuel oil accounted for seven percent, and electricity accounted for much less than one percent. The

three main types of baking ovens are the single lap, tunnel, and Lanham ovens. In the single lap oven, trays carry the product back and forth through the baking chamber once. The single lap oven is the most common type of oven and is popular due to its long horizontal runs, extensive steam zone, and simple construction. The tunnel oven is slightly more efficient and more expensive that the single lap oven. IN the tunnel oven, the hearth is a motorized conveyor which passes in a straight line through a series of heating zones, with loading and unloading occurring at opposite ends of the oven. The advantages of the tunnel oven include flexibility with respect to pan size and simple, accurate top and bottom heat control. The tunnel oven is used exclusively in the cookie and cracker baking, with the product being deposited directly on the oven band. The most recently developed type of oven is the Lanham oven. The Lanham oven is the most efficient type of oven, with a per pound energy consumption approaching the practical minimum for baking bread. Between one--half and two--thirds of all new industrial baking ovens are Lanham ovens. In the Lanham oven, the product enters the oven near the top of the chamber, spirals down through a series of heating zones, and exits near the bottom of the oven. The oven is gas--fired directly by ribbon burners. 31 refs.

48153 (IT—8711, pp 11) **Presentation to the 3rd Annual Canadian Natural Gas Marketing Conference.** Orr, C.K. 1987. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01608; CONF-8711212—).

From 3. annual Canadian natural gas marketing conference; Calgary, Canada (24 Nov 1987).

This paper is a natural gas producer's/marketer's review of deregulation two years after it's enactment. It deals with the three basic areas of the agreement: pipeline access, volumes and prices, and regulatory barriers to exports. The author concludes that deregulation is working for the consuming sector, but to date, for a large segment of the producing sector, it is not; US market access has not improved. He also states that in the longer-term, deregulation will work for the producing sector, as long as a mandated surplus does not re-appear, or National Energy Board decisions on proposed future export sales do not have the same effect.

48154 (IT—8711, pp 5) **Is Canadian gas really a good buy?.** (Brooklyn Union). 1987. Infotech, St., 200, 1015 Centre St.,N., Calgary, Alta., Canada T2F 2P8; $35.00 CAN. (CE—01608; CONF-8711212—).

From 3. annual Canadian natural gas marketing conference; Calgary, Canada (24 Nov 1987).

The author briefly discusses the advantages of importing Canadian natural gas to the US and provides examples of how Brooklyn Union has benefitted from this practice. He also demonstrates the attractiveness of the American market to Canadian suppliers.

48155 (IT—8711, pp 14) **Is open-access a reality?.** Miles, P.L. 1987. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01608; CONF-8711212—).

From 3. annual Canadian natural gas marketing conference; Calgary, Canada (24 Nov 1987).

The author addresses such questions as the following. Is the open distribution concept working? Are there better alternatives? Will new rate methodologies be required if pipelines opt more for a carriage and less for a sales role? In a competitive market, how should the risk of new capacity investment be shared among or by producers, marketers, shippers and buyers? The paper focuses on the TransCanada pipeline, and briefly reviews the changes that have occurred in federal regulation of natural gas markets, and the results.

48156 (IT—8711, pp 8) **Why doesn't everybody buy short term?.** Minion, D.W. (Northridge Petroleum Marketing, Inc., Calgary, Alta.). 1987. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01608; CONF-8711212—).

From 3. annual Canadian natural gas marketing conference; Calgary, Canada (24 Nov 1987).

The author evaluates the factors involved in making decisions in regards to buying natural gas on a short term basis. Aspects discussed are self interest, and economic, political and psychological factors involved with both buying and selling.

48157 (IT—8711) **Deregulation - is it working?.** (InfoTech, Calgary, Alberta (Canada); Economics Society of Calgary, Alberta (Canada); Planning Forum-Calgary Chapter, Alberta (Canada)). 1987. Vp. (CE—01608; CONF-8711212—). Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN.

From 3. annual Canadian natural gas marketing conference; Calgary, Canada (24 Nov 1987).

This conference dealt with the effects of deregulation on natural gas marketing and pricing, as well as other economic factors in the industry. Included in this report is a transcript of question and answer sessions addressing deregulation, distribution, contracts and marketing. Speakers included representatives of both Canadian and American government and industry. Separate abstracts were prepared for six papers.

0307 Waste Management

REFER ALSO TO CITATION(S) 48689

48158 **Characterization and treatment of spent hydrostatic test water in the natural gas industry.** Sprester, F.R.; Cadena, F.; Fingleton, D.J. (City of El Paso, El Paso, TX (US)). pp 488-496 of Proceedings of the 41st industrial waste conference. Chelsea, MI; Lewis Publishers (1987). (CONF-860527—).

From 41. annual Purdue industrial waste conference; West Lafayette, IN, USA (13 May 1986).

Meyer estimates that over one million miles of collection and distribution pipelines are presently in use by the natural gas industry in the United States. These lines are used to transport natural gas from the production fields to the consumer. The Institute of Gas Technology reports that gas pipelines are periodically tested for integrity using any one of the following procedures: acoustic, hydrostatic, isotopic, radiographic, and ultrasonic techniques. Hydrostatic testing of natural gas pipelines is one of the most popular means for leak detection since it offers the additional advantage of removing obstructions in the pipeline. The main intent of such testing is to identify weakness in the pipeline by hydrostatically pressurizing a segment of pipeline. Minimum test pressures have been established by industry associations and the U.S. Department of Transportation for various operating pressures. Water used in hydrostatic tests is often disposed without treatment into temporary infiltration (percolation) pits or into any nearby ditch or body of water. Land disposal of these wastes is usually followed by site recovery using a soil layer to cover the remaining sludge. Natural gas pipelines have been recently recognized as sources of contamination to groundwater. Some preliminary guidelines to minimize the environmental impact of wastes generated by the natural gas industry during hydrostatic testing of transmission pipelines are presented in this document.

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 48121

0309 Artificial Stimulation

48159 **(PB—88-220017/XAB) Coalbed Methane Production and Stimulation (COMPAS) Data Base: documentation and user's manual. Topical report.** Bell, G.J.; Jones, A.H. (Terra Tek, Inc., Salt Lake City, UT (USA)). Jan 1988. 101p. (TR—88-39). NTIS, PC A06/MF A01.

This database was established to facilitate study of behavior and performance of hydraulic fracture treatments in coal seams. Constructed on a personal computer, COMPAS provides consistent formatting and analysis on large amounts of data gathered on 172 hydraulic fracture stimulation treatments for 122 coalbed methane wells from across the United States. To use the system, an operator need only know how the files are organized. Basic information re-

trievals are menu-driven, with five basic functions available: Data Entry Screens, List Commands, Reports, Plots, and Crossplot Utilities.

48160 **(PB—88-220033/XAB) Advancements in Travis Peak Formation evaluation and hydraulic-fracture technology: staged field experiment No. 1, Waskom Field, Harrison County, Texas. Topical report, August 1986-April 1987.** Peterson, R.E. (CER Corp., Las Vegas, NV (USA)). Apr 1988. 279p. NTIS, PC A13/MF A01.

The Gas Research Institute has sponsored research directed toward improving the recovery efficiency and reducing the cost of producing gas from tight reservoirs. To more effectively acquire data and perform research experiments, the concept of Staged Field Experiments (SFE) was developed. SFE No. 1 had specific objectives which included implementing data collection methods which would be structured to benefit the research contractors advancing various formation evaluation and hydraulic fracture technologies. The results of the data acquisition and research are presented and include sections relative to geology, formation evaluation, stress profiling, pre- and post-fracture production testing, hydraulic fracture diagnostics, and hydraulic fracture design/control, and reservoir simulation.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 48138, 48758

48161 **(ERCB—D88-8) Decision D88-8 regarding Chevron Canada Resources Ltd. gas plant expansion, Pouce Coupe Field, application 871060, and Dome Petroleum Ltd. rateable take, Pouce Coupe Kiskatinaw D Pool, Application 880038.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 17 Jun 1988. 19p. (CE—01805). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

Chevron Canada Resources submitted an application under the Oil and Gas Conservation Act for approval to increase the maximum capacity of its Pouce Coupe sweet gas processing plant (Alberta) by 250,000 m/sup3//d of raw gas. If approved, the plant would process a maximum of 560,000 m/sup3//d of raw gas. At the same time, Dome Petroleum Limited, on behalf of itself and 4 other companies affected by such increased production, submitted an application for an order to restrict the total volume of gas that may be produced from the Pouce Coupe Kiskatinaw D Pool from three wells in that pool and to distribute the volume of gas so produced among the three wells named. The applications were considered at a public hearing before the Energy Resources Conservation Board (ERCB), which considered the issues to be: the delineation of the D Pool; the proposal for additional processing capacity at the plant; the need for a rateable take order; and the basis for distributing production and the details of a rateable take order, if one is to be issued. After discussing the characteristics of the D Pool that would affect production from the wells in which the companies involved had an interest, and hearing other matters pertaining to the issues outlined above, ERCB concluded that Chevron's application was technically sound, had adequately addressed the environmental protection issue, and had addressed all of the pertinent matters; the application was approved. The ERCB was unable to conclude that Dome would be deprived of its opportunity to produce its share of D Pool reserves if additional gas is taken to satisfy the gas plant needs, and thus was not prepared to approve Dome's rateable take application. 3 figs., 2 tabs.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 50294

0330 Properties

REFER ALSO TO CITATION(S) 48344, 48345, 49153

0340 Combustion

REFER ALSO TO CITATION(S) 48869, 48871

48162 **(PB—88-214606/XAB) Basic research on natural gas combustion phenomena - catalytic combustion. Annual report 1987. Report for 15 January 1987-14 January 1988.** Quinlan, M.A.; Wise, H.; McCarty, J.G. (SRI International, Menlo Park, CA (USA)). Mar 1988. 73p. NTIS, PC A04/MF A01.

See also report for 1986, PB—87-213153.

The intrinsic methane combustion activity of a series of metal oxide catalysts representing several structural classes was determined by temperature-programmed reaction and stationary-state order of reaction experiments. The oxide catalysts examined thus far include: (1) a series of lanthanum-based transition metal 1,1-perovskites; (2) a layered perovskite, La_2NiO_4; (3) $YBa_2Cu_3O_7$, the superconducting perovskite; (4) several alumina spinels; and (5) simple binary oxides of disparate structure. These metal oxide catalysts were typically prepared by conventional precipitation and calcination methods and characterized by x-ray diffraction, BET surface area, and the temperature-programmed evolution of oxygen. When normalized for surface area, the specific methane combustion activity of transition metal oxides correlates inversely with their thermochemical stability. The performance of the oxide catalysts was greatly influenced by sintering at elevated temperatures. The most-stable oxide was the lanthanum-alumina perovskite, $LaAlO_3$, which was stable up to 1473 K. The kinetics of catalytic methane combustion were examined in detail for selected catalysts.

48163 **(PB—88-216817/XAB) Gas-fired ferrous shaft melter development. Extended-melting trials. Final report, March 1985-February 1986.** (Surface Combustion, Inc., Toledo, OH (USA)). 24 Mar 1988. 275p. (REPT—1326). NTIS, PC A12/MF A01.

The technical suitability of the Gas-Fired Ferrous Melter (GFFM) equipment, operation and performance for application to the Iron Foundry Industry has been determined in a 24-inch-diameter Experimental Unit. Eight certification melting trials were conducted on the GFFM over the period from July 1985 to January 1986. Over 60 tons of ferrous scrap, including mixtures containing 25% steel scrap, were melted in 35 hours of melting operation. Melting tests of eight to nine hours demonstrated the natural gas-fired melter component hardware endurance, specifically, the burners, the burden support and shaft refractory lining, and reduced flue gas emissions. Although the GFFM certification trials did not demonstrate the optimum thermal performance, the test data indicates that the energy consumption can be potentially improved to where the natural gas usage is projected to be 3.0 MM Btu/ton of metal melted for a 5-to-10 tons/hr unit.

48164 **(PB—88-220058/XAB) Basic research on radiant burners. Annual report, February 1987-January 1988.** Kendall, R.M.; DesJardin, S.T. (Alzeta Corp., Santa Clara, CA (USA)). Apr 1988. 45p. (ALZETA—88-727-141). NTIS, PC A03/MF A01.

During the first year of the project, significant progress was made in flame attachment and radiant-output studies of radiant surface burners. Predictions of surface radiation and flame liftoff were made with a surface-modified flame-chemistry computer model. These predictions agree remarkably well with experimentally measured radiation and flame liftoff for a ceramic fiber burner under a wide range of operating conditions. Experimental data for two other types of radiant burners were also compared with the computer-model predictions. A doubling of radiant output at low

excess-air levels with similar flame-liftoff stability limits was demonstrated on a platinum-coated ceramic-fiber burner compared with a conventional ceramic-fiber burner. Flashback will be studied computationally and experimentally in the second year of the project. Radiant output will be the focus of the third year.

04 OIL SHALES AND TAR SANDS

0403 Drilling, Fracturing, And Mining

48165 (EGG-M—88289) [Oil shale mining and material handling technology assessment]: Period of performance, November 1986--March 1988. Knutson, C.F.; Smith, R.P. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 10p. (CONF-880725—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015181/JAW.

From 3 annual oil shale, tar sands and mild gasification contractors review meeting; Morgantown, WV, USA (19 Jul 1988).

Mining and materials handling operations were perceived to account for an appreciable part of the estimated cost of the operating cost, according to a recent DOE publication. Thus, advances in the M&MH technology have the potential to effect a marked reduction in the cost of reproducing shale oil. This project and the resulting assessment document is one of the steps DOE has taken to reassess the role of M&MH research in the oil shale program. Major conclusions of the review of extraction technology are: (1) Very large volumes of oil shale must be mined in order to make significant contributions to US oil supply. The direction of future research activities should influenced by the need to develop high volume mining systems. At present, open pit, stopping with backfill, and block caving offer the most promise. (2) Mechanical mining machine using disc or roller cutters (such as tunnel boring machines, shaft drills, and raise bores) are capable of high drivage rates in oil shales and should be carefully evaluated for underground mine development. High speed drill and blast techniques offer comparable drivage rates. (3) Mechanical mining machines using dragbits are taxed by the strength of oil shale. Major breakthroughs in bit material hardness and heat resistance are needed before dragbit machines can be used. Research in various components of mining systems (roof support/slope stability, ventilation, transport, blasting efficiency, backfill, and reclamation) offer the most hope for short term benefits.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 48032, 48062, 48178, 48180, 49243

48166 (DOE/MC/11076—2455) Western Research Institute: Annual technical progress report, October 1986--September 1987. (Western Research Inst., Laramie, WY (USA)). Oct 1987. Contract FC21-86MC11076. 163p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88009106/JAW.

Accomplishments for the year are presented for the following five areas of research: oil shale, tar sand, underground coal gasification, advanced process technology, and advanced fuel research. Oil shale research covers: chemical and physical characterization of reference shales; oil shale retorting studies; and environmental base studies for oil shale. Tar sand covers: reference resource (tar sand deposits) evaluation; chemical and physical propeerties of reference tar sand; recovery processes; mathematical modeling; product evaluation; and environmental base studies. Underground coal gasification covers environmental impact assessment and groundwater impact mitigation. Advanced process technology includes advanced process analysis (contaminant control and new technology) and advanced mitigation concepts. Advanced fuels research is on jet fuels from coal. (AT).

48167 (NP—8770355) Removal of μ-sized particles from viscous liquids. Final report. Peter, S.; Fexer, W.; Jaumann, W. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Technische Chemie; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Feb 1986. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770355/JAW.

Ash removal from shale oil by supercritical fluid extraction in continuous operation was investigated. The shale oil was extracted from Moroccan oil shale by low-temperature carbonisation according to the Lurgi-Ruhrgas process; it contained 25 to 30% by weight of solid matter, with grain sizes from 0.8 to 13 μm. About 85 to 90% by weight of the oil was recovered as product. The extracted oil was absolutely free of solids. Extraction took place with propane as supercritical component and toluene as entrainer under conditions in which the quasiternary system shale coil/toluene/propane is a single-phase system. The solid particles were suspended in an aqueous solution set at pH 11 by means of calcium hydroxide. At a solids concentration of 30 to 60% by weight, the solution is comparatively fluid and could be removed from the extractor via a tube with an internal diameter of 6 mm. After evaporation of the water, a loose black powder was obtained which contained 20 to 30% by weight of organic materials. (orig./RB) With 68 figs., 1 tab., 9 refs.

48168 (SC—814E) The effects of pore size in MoO/sub 3/-CoO-Al/sub 2/O/sub 3/ hydrocracking catalysts. Hardin, A.H.; Ternan, M.; Packwood, R.H. (Syncrude Canada Ltd., Edmonton, Alberta; Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Energy Research Labs.; Petroleum Association of Conservation of the Canadian Environment, Ottawa, Ontario). Aug 1981. 36p. (CE—01684). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Effects of variations in mean pore diameter in four series of catalysts have been determined for hydrodesulphurization, hydrodenitrogenation and conversion reactions of Athabasca bitumen. Standard tests were made on a blank alumina support and three cobalt/molybdenum/alumina catalyst series having the compositions 1.1:2.2, 4.4:8.8 and 3.0:15.0 m % CoO:MoO/sub 3/, respectively. Several median pore diameter ranges were tested for each catalyst. Some physical properties of the prepared catalysts were measured. Median pore diameter distributions, determined by Hg penetration, had values between 7.0 and 100.0 nm. Pore volumes varied between 0.25 and 0.65 ml/g. Surface areas were found to vary from 1 to 200 m/sup 2//g. Used catalysts were de-oiled by benzene extraction prior to analysis by electron microprobe and prior to analysis for deposited coke content. A stainless-steel tubular reactor was filled with a fixed bed of catalyst. Premixed bitumen and hydrogen were bottom-fed to the reactor at a liquid hourly space velocity of 1.0. Standard operating conditions of 13.9 MPa, 440/sup 0/C and 800 l of H/sub 2/ per litre of feed were used in all cases. The catalysts were all presulphided with bitumen immediately prior to the studied reactions. Mounted and sectioned catalyst specimens were subjected to electron microphobe analyses which indicated distinct variations in the radial distribution of Fe, Ni, V, and S across the catalysts. Effects of pore size variations on hydrodesulphurization, hydrodenitrogenation, pitch conversion and coke formation were determined. The results indicated maxima for mass per cent sulphur removal for pores near 15 nm for two catalysts. As well, the rates per unit area for S and N removal increased as mean pore diameters increased to about 50 nm, after which the rates appeared to be constant. 49 refs., 39 figs., 8 tabs.

48169 (UCRL—99286) Rapid pyrolysis of Green River and New Albany oil shales in solid-recycle systems. Cena, R.J. (Lawrence Livermore National Lab., CA (USA)). Jul 1988. Contract W-7405-ENG-48. 14p. (CONF-880850—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015444/JAW.

From American Institute of Chemical Engineers summer national meeting; Denver, CO, USA (21 Aug 1988).

We are studying second generation oil shale retorting by a combined laboratory and modeling program coupled with operation of a 1 tonne-per-day solid-recycle pilot retorting facility. In the retort, we have measured oil yields equal to Fischer assay for Western, Green River shale and Eastern, New Albany shale. Laboratory experiments have measured yields of 125% of Fischer assay under ideal conditions in sand fluidized beds. However, when oxidized (or spent) shale is present in the bed, a decline in yield is observed along with increased coke formation. Recycling clay catalysts may improve oil yield by olefin absorption on active sites, pre-

venting coke formation on these sites and allowing olefin incorporation into the oil. We studied the solid mixing limits in solid-recycle systems and conclude that nearly intimate mixing is required for adequate heat transfer and to minimize oil coke formation. Recycling oxidized shale has shown to self-scrub H_2S and SO_2 when processing Western shale. Cooling of spent shale with water from 500{degree}C releases H_2S. We describe an apparatus which uses solid-recycle to reduce the temperature before water spray to cool the shale without H_2S release. 6 refs., 5 figs., 2 tabs.

48170 **(UCRL—99321) LLNL oil shale project review: METC third annual oil shale contractors meeting.** Cena, R.J.; Coburn, T.T.; Taylor, R.W. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 43p. (CONF-880725—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015448/JAW.

From 3 annual oil shale, tar sands and mild gasification contractors review meeting; Morgantown, WV, USA (19 Jul 1988).

The Lawrence Livermore National Laboratory combines laboratory and pilot-scale experimental measurements with mathematical modeling of fundamental chemistry and physics to provide a technical base for evaluating oil shale retorting alternatives. Presented herein are results of four research areas of interest in oil shale process development: Recent Progress in Solid-Recycle Retorting and Related Laboratory and Modeling Studies; Water Generation During Pyrolysis of Oil Shale; Improved Analytical Methods and Measurements of Rapid Pyrolysis Kinetics for Western and Eastern Oil Shale; and Rate of Cracking or Degradation of Oil Vapor In Contact with Oxidized Shale. We describe operating results of a 1 tonne-per-day, continuous-loop, solid-recycle, retort processing both Western And Eastern oil shale. Sulfur chemistry, solid mixing limits, shale cooling tests and catalyst addition are all discussed. Using a triple-quadrupole mass spectrometer, we measure individual species evolution with greater sensitivity and selectivity. Herein we discuss our measurements of water evolution during ramped heating of Western and Eastern oil shale. Using improved analytical techniques, we determine isothermal pyrolysis kinetics for Western and Eastern oil shale, during rapid heating, which are faster than previously thought. Finally, we discuss the rate of cracking of oil vapor in contact with oxidized shale, qualitatively using a sand fluidized bed and quantitatively using a vapor cracking apparatus. 3 refs., 4 figs., 1 tab.

48171 **EPA, ASTM, and column leaching of processed oil shale - A comparative study.** Sorini, S.S.; Donovan, R.C. (Div. of Environmental Chemistry, Western Research Institute, Laramie, WY (US)). pp 229-240 of Nineteenth oil shale symposium proceedings. Gary, J.H. Golden, CO; Colorado School of Mines Press (1986). (CONF-8604172—).

From 19. annual oil shale symposium; Golden, CO, USA (21 Apr 1986).

Four laboratory leaching methods (the Environmental Protection Agency (EPA) extraction procedure, ATSM method D3987, and two column tests) were used to extract leachates from four low-void retorted oil shales to 1) compare the leaching procedures based on the chemical characterization of leachates derived from leaching method and 2) establish the toxicity of each leachate relative to published EPA water quality criteria. The EPA extraction procedure extracted the greatest concentration of trace elements of the methods tested. None of the concentrations of the seven metals (arsenic, barium, cadmium, chronium, lead, selenium, and silver) selected from those listed in the Resource Conservation and Recovery Act (RCRA) exceeded the RCRA limits defining a hazardous waste. On that basis, the low-void retorted oil shales would not be classified as hazardous.

48172 **Sunlight photochemistry of retort-water organonitrogen compounds in an inert atmosphere.** Blatchley, E.R. III; Daughton, C.G.; Thomas, J.F. (Applied Science Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). pp 199-207 of Nineteenth oil shale symposium proceedings. Gary, J.H. Golden, CO; Colorado School of Mines Press (1986). (CONF-8604172—).

From 19. annual oil shale symposium; Golden, CO, USA (21 Apr 1986).

The elevated temperature of an oil-shale codisposal process will enhance the atmospheric emission of volatile components. Important among the organic compounds are the nitrogen heterocycles and aromatic primary amines, which are characterized by malodor and low odor thresholds and by resistance to biotreatment. Atmospheric lifetimes are determined by various transport (e.g., dispersion, washout) and transformation phenomena. Photochemical alteration will be the major transformation process. Those compounds that degrade quickly may increase the atmospheric NO/sub x/ concentration, giving the potential for photochemical smog formation. Those with longer lifetimes may present health and asethetic problems. The broad spectrum of compound types and isomers present in process-water headspace samples may result in a range of atmospheric lifetimes. The work reported here is the first investigation of vapor-phase atmospheric photoreactions leading to degradation or organonitrogen compounds emitted from process waters.

48173 **Oil shale process water evaporation.** Hasfurther, V.R.; Reeves, T.L.; McQuisten, R.; Haass, M.J. (Univ. of Wyoming, P.O. Box 3295, University Station, Laramie, WY (US)). pp 190-198 of Nineteenth oil shale symposium proceedings. Gary, J.H. Golden, CO; Colorado School of Mines Press (1986). (CONF-8604172—).

From 19. annual oil shale symposium; Golden, CO, USA (21 Apr 1986).

Evaporation research is being conducted on oil shale process wastewaters at Laramie, Wyoming using Class-A evaporation pans. Evaporation rates from the pans are measured at 30-minute to hourly intervals throughout the evaporation season. In addition, meteorological parameters are collected simultaneously. Based on the analysis of evaporation and meteorological data, it was found that Class-A pan water temperatures were a good indicator of the relative evaporation rates between process waters that the majority of pan evolution occured between noon and midnight. Actual evaporation of two oil shale process wastewaters were found to evaporate 9.9 and 18.3 percent slower than freshwater on a daily basis. Regression models for the oil shale wastewaters were developed to predict hourly Class-A pan evaporation, using those meterological parameters found to have the most significant effects on evaporation (air temperature, relative humidity, solar radiation, and wind). Present studies are concerned with emission rates of the evaporation process and its possible pollution effect on the environment as well as evaporation rates of different oil shale process waters.

48174 **Uniform retorting of an anisotropic shale bed.** Bickel, T.C.; Cook, D.W.; Engler, B.P. (In Situ Technologies Div., Sandia National Labs., Albuquerque, NM (US)). pp 126-138 of Nineteenth oil shale symposium proceedings. Gary, J.H. Golden, CO; Colorado School of Mines Press (1986). (CONF-8604172—).

From 19. annual oil shale symposium; Golden, CO, USA (21 Apr 1986).

In situ oil shale retorts have typically been designed for the fracturing event to produce a rubble bed having uniform cross-sectional rubble properties. This uniform rubble bed approach strived to produce constant void fraction and particle size distribution within all regions of the rubble bed. Ideally, these isotropic rubble beds have uniform flow of oxidants, retorting and combustion products. However, edge effects during the blast event (which affect both particle size and void) typically produce channeling at the retort walls during processing, reducing the rubble sweep and the local yield. Previous laboratory and field work have demonstrated this effect significantly reduces retort yield. Current blast designs have been unsuccessful thus far in overcoming wall effects. Since it is unlikely that process control parameters can provide any significant yield improvement in non-uniform retorts, any large improvement in retort yield must come from improved rubblization concepts.

48175 **Results and interpretation of rapid-pyrolysis experiments using the LLNL solid-recycle oil shale retort.** Cena, R.J.; Mallon, R.G. (Lawrence Livermore National Lab., P.O. Box 808, Livermore, CA (US)). pp 102-125 of Nineteenth oil shale symposium proceedings. Gary, J.H. Golden, CO; Colorado School of Mines Press (1986). (CONF-8604172—).

From 19. annual oil shale symposium; Golden, CO, USA (21 Apr 1986).

Virtually all rapid pyrolysis oil shale retorting processes currently under study utilize some form of hot-solid as the heat carrying medium. The conditions under which rapid retorting is achieved call for rapid mixing of the solid heat carrier and raw shale followed by a 2-3 minute soak period during which pyrolysis occurs. Both chemically active and inactive solid heat carriers have been proposed (e.g. recycled shale and ceramic balls) along with a number of processing strategies (e.g. fluidized beds, rotating drums and mechanical mixers and soak bins). To assess the merits of the various processing alternatives, a thorough understanding of the chemistry and physics involved in solid-recycle retorting is required. At Lawrence Livermore National Laboratory (LLNL) the authors are studying the chemistry and physics of solid-recycle retorting in a 2 ton/day continuous-loop pilot scale facility.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 48166

48176 (AU/C—1982) Chemical stabilization of the polar fractions of petroleum for study by field ionization mass spectroscopy. Progress report, May 1, 1981-March 31, 1982. (Alberta Univ., Edmonton (Canada). Dept. of Chemistry). 1982. 49p. (CE—01718). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A survey of the chemical types present in the polar fraction of Athabasca maltenes has been completed using a combination of elution chromatography followed by high vacuum sublimation subsequent analysis by field ionization mass spectroscopy. This has revealed the presence of two homologous series of compounds of the form C/sub n/H/sub 2n-15/N and C/sub n/H/sub 2n-17/N. In addition two series of compounds of the form C/sub n/H/sub 2n-18/O and C/sub n/H/sub 2n-24/O were found belonging to the phenol class and a homologous series of dibenzofurans of the form C/sub n/H/sub 2n-16/O. The nitrogen-containing homologous series in Athabasca bitumen belong to the neutral or carbazole class in contrast to the nitrogen compounds found in coal which are basic amines or pyridines. A class of sulphoxides was discovered containing a large number of compounds. Of particular significance was a sub class of alicyclic sulphoxides which are present in concentrations comparable with the carboxylic acids. 11 refs., 20 figs., 4 tabs.

48177 Influence of weathering/preoxidation on the devolatilization mechanisms of oil shale. Khan, M.R. (US Dept. of Energy, Morgantown Energy Technology Center, Morgantown, WV (US)). pp 139-148 of Nineteenth oil shale symposium proceedings. Gary, J.H. Golden, CO; Colorado School of Mines Press (1986). (CONF-8604172—).

From 19. annual oil shale symposium; Golden, CO, USA (21 Apr 1986).

To better understand the influence of preoxidation on the devolatilization mechanisms of oil shale, a western (Colorado) and an eastern (Kentucky) oil shale and their corresponding organic fractions (and a Pittsburgh seam coal, for comparison) were preoxidized in dry air at 150°C for up to 6 days. Elemental analyses of the preoxidized and untreated samples indicate that H/C ratios of the samples are significantly reduced during 6 days of oxidation. TGA data show that preoxidation of these carbonaceous materials significantly reduces the overall weight loss (and the maximum rate of weight loss) during subsequent pyrolysis. Microdilatometer studies suggest that the fluid intermediate states of oil shale kerogen, normally observed as contraction during heating, are destroyed by 6 days of oxidation. Analyses of evolved light gases from the TGA/MS indicate that preoxidation of oil shales or their organic fractions increases evolution of H/sub 2/O and CO/sub 2/ during pyrolysis. While the yield of oxygenated species increases, the production of hydrocarbons (CH/sub 4/ and C/sub 2/H/sub 6/ in particular) and H/sub 2/ is markedly reduced. These findings led to the hypothesis that preoxidation of oil shale organics introduces oxygen-cross-linking bridges and/or reduces the aliphatic hydrogen contents of the shale samples. The hypothesis was tested by Fourier transform infrared spectroscopy which confirmed that preoxidation of the shale organics introduces oxygenated functional groups such as carbonyl and carboxylic while there is a marked reduction in the aliphatic hydrogen content of the samples. The results suggest that part of the oxygen functional groups undergo decomposition and evolve during subsequent pyrolysis as H/sub 2/O and CO/sub 2/ at the expense of desirable hydrocarbon fuels.

0407 Health And Safety

REFER ALSO TO CITATION(S) 48116

0409 Waste Research And Management

REFER ALSO TO CITATION(S) 48173, 48175

48178 Ammonia removal from oil shale process waters using tubular, microporous polytetrafluoroethene membranes. Sakaji, R.H.; Daughton, C.G.; Selleck, R.E.; Thomas, J.F. (Applied Science Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). pp 208-216 of Nineteenth oil shale symposium proceedings. Gary, J.H. Golden, CO; Colorado School of Mines Press (1986). (CONF-8604172—).

From 19. annual oil shale symposium; Golden, CO, USA (21 Apr 1986).

Oil shale process waters can contain high concentrations (1 to 30 g/L) of dissolved ammonia/ammonium ion, most of which must be removed prior to discharge or codisposal. Nonosomotic dissolved-gas analysis dialysis (NOGD), a membrane separation process that uses tubular, microporous hydrophobic polytetrafluroethene (PTFE) membranes, is being evaluated as an alternative to conventional ammonia removal methods, such as steam stripping. Unlike most conventional methods, NOGD is more selective for ammonia, and it combines both removal and recovery of ammonia in a single unit process. The PTFE membrane serves as a gaseous barrier between two aqueous phases. Dissolved ammonia diffuses from the wastewater through the gaseous interface to an acidic absorption (dialysate), which serves to maintain the concentration gradient of ammonia gas across the membrane wall. This separation process has been described in a numeric model based on the diffusive transport of ammonia. For the ammonium hydroxide solution, correlation between the numeric model and experimental results was greater than 90% using mass-transfer coefficients as the basis of comparison; correlation between the model and experimental data for waters from three oil shale retorts (Occidental burn #6 (Oxy-6), Geokinetics-9, and Paraho) was poorer. On the basis of hydraulic residence times (HRT), the ammonia removals attained were 56% for Oxy-6 (0.92 min HRT), 55% for Geokinetics (0.87 min HRT), and 64% for Paraho (0.83 min HRT). These results from bench-scale experiments demonstrate the potential of NOGD as a rapid ammonia removal process.

48179 Decommissioning of the U.S. Department of Energy Anvil Points Oil Shale Research Facility. Virgona, J.E. (US Dept. of Energy, Naval Petroleum and Oil Shale Reserves, Grand Junction, CO (US)). pp 161-176 of Nineteenth oil shale symposium proceedings. Gary, J.H. Golden, CO; Colorado School of Mines Press (1986). (CONF-8604172—).

From 19. annual oil shale symposium; Golden, CO, USA (21 Apr 1986).

After almost 40 years of pioneering oil-shale mining, processing, and environmental research and development by government and industry, the Anvil Points Oil Shale Research Facility (APF) near Rifle, Colorado, is being decommissioned. In the spring of 1984, with the Facility no longer needed for oil-shale research, the U.S. Department of Energy decided to begin the $3 million decommissioning of the industrial (research) and housing structures. Decommissioning of the APF began in the summer of 1984 with the initiation of an environmental audit and subsequent hazard cleanup. The audit included sampling and analysis of all transformers, ponds, tanks, drums, and other containers; investigation of known and suspected spill areas; and an asbestos hazard survey. After the known and potential environmental hazards were identified, cleanup and disposal followed. Once the initial environmental hazard identification and cleanup were completed, a contract for asbestos removal and demolition and reclamation of the industrial plant and housing

area was awarded in the summer of 1985. The oil-shale mine, raw and retorted shale piles, and water treatment plant were not included. Asbestos removal and demolition are now completed, and reclamation is nearing completion.

0410 Environmental Aspects

REFER ALSO TO CITATION(S) 48166, 48171, 48172, 48173, 48175, 48179, 48180

0420 Regulations

48180 (ERCB/C—D88-7) Syncrude Mildred Lake oil sands plant. Decision on expansion application. (Energy Resources Conservation Board, Calgary, Alberta (Canada)). Jun 1988. 170p. (CE—01802). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta,, Canada T2P 3G4; $10.00 CAN.

Syncrude Canada applied under the Alberta Oil Sands Conservation Act for approval of an amendment to an existing approval to provide for the following: increased yearly production of marketable hydrocarbons from the currently approved facilities; production period to December 31, 2018; new oil sands mining and disposal areas; and construction and operation of the new facilities. The normal regulatory review was supplemented by establishing a consultative body comprising representatives of the Fort McKay Indian Band, Syncrude, and various interested Alberta government agencies. This group was charged with identifying the major issues and problems associated with application, identifying and resolving concerns where possible outside the context of a public hearing, and promoting dialogue. A final report of this group is included. Other organizations made contact with the review process and submitted their concerns. The consultative body's recommendations were accepted and the Syncrude expansion amendment was approved with respect to the new project areas, process plant facilities, the proposed sulfur recovery level, the yearly production rate, and the extension of the approval date to 2018; Syncrude was to obtain approval prior to construction of any new out-of-pit overburden disposal sites associated with the expansion. Another related intervention, included in this document, related to objection of using the warm slurry process and suggesting a new oleophilic sleeve process. It was judged that although the slurry process is satisfactory, new technology development is potentially important and a joint industry/government research program is advised. 20 figs., 12 tabs.

05 NUCLEAR FUELS

REFER ALSO TO CITATION(S) 48510

48181 (PB—88-206941/XAB) Robotics for nuclear facilities. Abe, A.; Nakayama, R.; Kubo, K. (Toshibe Corp., Tokyo (Japan). Principal Office). 1988. 4p. NTIS, PC E04/MF A01.

Text in Japanese; Included in Toshiba Review, Vol. 43, No. 1, 27-30(1988).

It is highly desirable that automatic or remotely controlled machines perform inspection and maintenance tasks in nuclear facilities. Toshiba has been working to develop multi-functional robots, with one typical example being a master-slave manipulator for use in reprocessing facilities. At the same time, the company is also working on the development of multi-purpose intelligent robots. One such device, an automatic inspection robot, to be deployed along a monorail, performs inspection by means of image processing technology, while an advanced intelligent maintenance robot is equipped with a special wheel-locomotion mechanism and manipulator and is designed to perform maintenance tasks.

0501 Reserves, Exploration, And Mining

REFER ALSO TO CITATION(S) 48306

48182 (INIS-BR—1147-Vol.2, pp 449-468) **Analytical standards for determining uranium and thorium.** Barreto, P.M.C. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Five reference standards made of natural matrices were prepared for uranium and thorium for distribution among national laboratories and research organizations. The physical preparation of the matrix, the homogenization and tests to qualify the standards as reference materials are discussed. This is the first set of such reference materials prepared in South America.

0504 Feed Processing

48183 (INIS-BR—1147-Vol.2, pp 357-365) **Thermal decomposition of uranyl nitrate by the Spray-Dryer process.** Wildhagen, G.R.S.; Silva, G.C. da. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The proposal of this work consist in the thermal decomposition of uranyl nitrate solutions by the Spray-Dryer process aiming at the production of highly reactive fluidized UO/sub 3/, adequate for the use in posterior of reduction to UO/sub 2/ and hydrofluorination to UF/sub 4/, in a fluidized bed for obtaining of UF/sub 6/ in the cycle of nuclear fuels.

48184 (INIS-BR—1147-Vol.2, pp 367-379) **Development of ammonium uranyl carbonate reduction to uranium dioxide using fluidized bed.** Gomes, R.P.; Riella, H.G. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Laboratory development of Ammonium Uranyl Carbonate (AUC) reduction to uranium dioxide (UO/sub 2/) using fluidized bed furnace technique is described. The reaction is carried out at 500-550/sup 0/C using hydrogen, liberated from cracking of ammonia, as a reducing agent. As the AUC used is obtained from uranium hexafluoride (UF/sub 6/) it contains considerable amounts of fluoride (/sup -/500{mu}gF/sup -//gTCAU) as contaminant. The presence of fluoride leads to high corrosion rates and hence the fluoride concentrations is reduced by pyrohydrolyisis of UO/sub 2/. Physical and Chemical proterties of the final product (UO/sub 2/) obtained were characterized.

0505 Uranium Enrichment

REFER ALSO TO CITATION(S) 48275, 49172

48185 (POEF-T—3479) Economic evaluation of potential reuse of ORGDP equipment at Paducah GDP and Portsmouth GDP. Warren, R.C. (Portsmouth Gaseous Diffusion Plant, OH (USA)). 8 Jun 1988. Contract AC05-76OR00001. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013522/JAW.

The relocation of up to 36 000 and 19 00 cells of barrier to Portsmouth and Paducah can be economically justified. In addition, relocation of some compressors, control valves and other piping would be required to maximize the benefit and assure operability. Models developed to perform the analyses described herein are readily adaptable to evaluate any modifications to the economic criteria and/or cost data upon which these studies were based.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 48318, 49162, 49163, 50007

48186 (DP-MS—86-141) Computer die design for ribbed tube extrusion. Peacock, H.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1986. Contract AC09-76SR00001. 5p. (CONF-8610427—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014515/JAW.

From 10. conference on the advances in the production of tubes, bars, and shapes; Orlando, FL, USA (9 Oct 1986).

Dies for coextrusion of nuclear reactor fuel elements with external ribs were designed using a computer program. The fuel elements comprise a uranium--aluminum alloy core and aluminum cladding. The computer-aided die design began with the finished tube dimensions and worked backwards to determine the die dimensions. Three dies were designed using the computer program. The design method gave excellent results.

48187 Gas-bubble growth mechanisms in the analysis of metal fuel swelling. Gruber, E.E.; Kramer, J.M. (Argonne National Lab., 9700 S. Cass Ave., Building 207, Argonne, IL (US)). pp 432-446 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

Under steady state conditions, irradiation resorption of fission gas from bubbles limits the swelling rates of metallic fast-reactor fuels to relatively small values. During transient thermal excursions, however, resorption effects diminish relative to thermal kinetics. Various bubble-growth mechanisms then become important components of the swelling. These mechanisms include growth by diffusion, for bubbles within grains and on grain boundaries; dislocation nucleation at the bubble surface, or "punchout"; and bubble growth by creep. Analyses of these mechanisms are presented and applied to provide information on the conditions and the relative time scales for which the various processes should dominate fuel swelling. The results are compared to a series of experiments in which the swelling of irradiated metal fuel was determined after annealing at various temperatures and pressures. The diffusive growth of bubbles on grain boundaries is concluded to be dominant in these experiments.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 48307, 49160, 49161, 49186

48188 (AERE-R—12654) Reduction of plutonium (IV) by hydrazine in presence of catalyst. McKay, H.A.C.; Wain, A.G. (UKAEA Harwell Lab. Chemistry Div.). Mar 1988. 21p. H.M. Stationery Office, London, price Pound 4.00.

Update of AERE-R--7323, (1973).

The reduction of Pu(IV) to Pu(III) in a nitric acid medium by means of hydrazine in presence of Pt/Al/sub 2/O/sub 3/ catalyst has been studied in both batch and catalyst column experiments. The batch experiments gave half-times of 2-3 min under the conditions used, at acidities in the range 0.5-1.25M HNO/sub 3/, implying 99.99% reduction in ~ 30 min. In the column experiments, rates about 10 times as fast would be expected. In general agreement with this, when the products of the column experiments were passed to a pulsed column for U/Pu separation, decontamination factors for Pu in the U stream were about 10/sup 4/ for 0.5-1.25M HNO/sub 3/, and would have been higher if the pulsed column had contained more stages; however, the separation deteriorated at 1.5M HNO/sub 3/. The catalyst behaved well, suffering negligible attrition, very very slight loss of Pt, and no loss of catalytic activity; irradiation even improved its performance. The experiments were carried out in a stream of H/sub 2//Ar or H/sub 2//N/sub 2/, but it was shown that this made a negligible contribution to plutonium reduction. The method could most conveniently be introduced into a fuel reprocessing flowsheet after a first co-decontamination cycle.

48189 (CEA-R—5436) Study of metabolism of hydrazoic acid in the purex process. Violet, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif; Institut National Polytechnique, 31 - Toulouse (France)). Mar 1988. 148p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88754721/JAW.

The transfer of HN/sub 3/ between different phases has been studied - It has been found that the transfer of HN/sub 3/ from aqueous solution of the reprocessing to gaz phase is a physical mechanism of desorbtion. - The limiting phenomena of the transfer of HN/sub 3/ fromt the organic to the gaseous phase, is the decomplexation of this specy with tributyl phosphate (TBP). - Chemical reactions of hydrazoic acid occurring with nitrogen oxides in the gaseous flow has shown that it is rapidly destroyed in the presence of nitrogen dioxide.

48190 (CONF-880815—1) Methods of testing HEPA filters with short upstream approaches. Kirk, G.Q.; Childress, C.E.; Schmoyer, D.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014552/JAW.

From 20. DOE/NRC nuclear air cleaning conference; Boston, MA, USA (22 Aug 1988).

The design of an air cleaning system to be used in a high gamma radiation field presented unique problems for in-place Dioctyl phthalate (DOP) leak testing. The design required remotely changeable HEPA (High Efficiency Particulates Air) filters in a throw-away, stainless steel housing, located underground in a stainless steel-lined concrete pit. The conventional approach of providing ten duct diameters of upstream mixing for the dispersion of testing the second filter stage in the system. To establish aerosol (DOP) injection ports that could provide mixing in accordance with ANSI N510-80, a full-scale housing was built. The housing and components were built of plexiglas to view the DOP streams. A series of tests were designed in which the following factors were varied: (1) aerosol distributors, (2) aerosol distributor locations, (3) baffle design, and (4) baffle location. DOP concentration measurements were taken immediately upstream of the filters. The uniformity score, as determined by ANSI N510-80, was defined as the larger of maximum minus average divided by average, or average minus minimum divided by the average values of DOP concentration. Three tests met the uniformity score requirement of 0.20, but all three had ten duct diameters of upstream mixing. The type of aerosol distributor, duct length, and flow rate were found to most affect the uniformity score. 5 figs.

48191 (CONF-880850—4) Operating experience with advanced centrifugal contractors in the integrated equipment test facility. Singh, S.P.; Welesko, P. (Oak Ridge National Lab., TN (USA); Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1988. Contract AC05-84OR21400. 22p. NTIS, PC A03. Order Number DE88015302/JAW.

From American Institute of Chemical Engineers summer national meeting; Denver, CO, USA (21 Aug 1988).

As part of the Consolidated Fuel Reprocessing Program (CFRP) at the Oak Ridge National Laboratory (ORNL), advanced design centrifugal contactors for nuclear fuel reprocessing have been operated for several years in the Integrated Equipment Test (IET) facility using depleted uranium. The mixing of the aqueous and organic phases in these contactors is achieved in the annular zone between the stationary housing and the rotor. Mass transfer tests with these contactors using depleted uranium have shown stage efficiencies in excess of 90%. Clarification of the feed to remove particles down to 2 μm was found to be necessary to prevent operational problems with the extraction bank. The status of the contactor drive system has been monitored using vibration analysis to increase the reliability of the solvent extraction system. 5 refs., 8 figs.

48192 **(DP-MS—88-17) SRL laboratory-scale fuel reprocessing facility.** O'Quinn, L.N.; Blancett, A. L. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 18p. (CONF-880801—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014929/JAW.

From International reprocessing and waste management symposium; Denver, CO, USA (21 Aug 1988).

A laboratory-scale multistage liquidliquid extraction experimental facility is nearing completion at the Savannah River Laboratory. The facility, designed to simulate the Purex process, will be utilized for development and evaluation of new process flowsheets, equipment configurations, inline analytical techniques, and process control strategies using dissolver solutions of irradiated nuclear fuels. The first Purex solvent extraction cycle is simulated with an 18-stage centrifugal contactor bank in a shielded cell. Two 4–stage mixer-settlers are also available in the cell to allow various flowsheet changes. Subsequent extraction cycles are simulated in an attached glovebox containing two 16-stage miniature mixer-settlers. Feed rates of 3 to 60 ml/min can be processed, for a scale reduction of 1:5000 to 1:1000 compared with typical plant throughputs. An overview of the facility's capabilities will be presented, plus a plan for how it will be used to support Savannah River Plant flowsheet improvements, develop new process flowsheets, confirm and improve computer simulations, and evaluate new instruments and control strategies.

48193 (INIS-BR—1147-Vol.2, pp 325-336) **Evaluation and performance of mixer-settlers used for actinide extraction.** Camilo, R.L.; Goncalves, M.A.; Carvalho, E.I. de; Nakazone, A.K.; Araujo, B.F. de; Araujo, J.A. de. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

This paper deals with four conceptions of mixer-settlers used for actinide purification and recovery. By means of the uranium concentration profiles in the organic and aqueous phases, the evaluation of each mixer-settler was made. The main purpose of this work is the data acquisition, for adapting the different contactor types to actinide recovery by liquid-liquid extraction, in the nuclear fuel cycle.

48194 **(INIS-mf—11712) In-line determination of uranium, neptunium and plutonium in process streams by means of energy-dispersive X-ray fluorescence analysis.** Hoffmann, P.; Pilz, N.; Hofmann, T.; Lieser, K.H. (Technische Univ. Darmstadt (Germany, F.R.). Lehrstuhl fuer Kernchemie; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1987. 39p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754589/JAW.

Extensive preparatory investigations have been made for this project that refer to choosing the proper source of radionuclide excitation, the detector/sample/source arrangement, and the collimation of source and detector. Optimized measuring arrays using Ba-133 (10 mCi) or Ir-192 (10 Ci), respectively for X-ray K-line excitation have been set up and used for determining calibration curves for the analysis of U, Np, and Pu in solutions that vary in concentration over several orders of magnitude. A measuring system has been built up for analysing solutions flowing through a pipe system. The measuring system consists of a sample chamber, 2 pumps, 2 rotameters, 2 solution containers and a mixing chamber, allowing continuous concentration measurement. The high-purity Ge detector is placed at the pipe system. Multi-channel analysis is done on a self-made, computer-integrated RAM buffer frame. The results can be displayed, printed out, or plotted, and can also be used for process control. For evaluation of the X-ray or γ-spectra, the digital filter method is applied.

48195 **(INIS-mf—11730) Results on the separation of micro-drops after the extraction process in reprocessing plants for nuclear power plant fuels. Final report.** Rebelein, F.; Blass, E. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1987. 67p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754591/JAW.

This research process aims at the separation of micro-drops from liquid process-flows. In order to characterize the liquid-liquid dispersions a measuring technique for the drop size was adapted and batch settling experiments were performed. In continuous steady state experiments the separation of dispersions with the aid of fibre beds was examined. These experiments provided batch settling times and the separation performance as a function of drop size, volumetric throughput, kind and thickness of fibre, bed depth and hold-up for fibre bed settlers. A progression project will examine an electrostatic settler for comparison. There are application possibilities for the achieved results in all separation processes in the range of nuclear power techniques, of the chemical industry and of waste-water technology. (orig.) With 18 refs., 3 tabs., 33 figs.

48196 **(LA-UR—88-1366) Near-quantitative recovery of actinides from nitric acid waste streams by solvent extraction using DHDECMP [dihexyl-N,N-diethylcarbamoylmethylphosphonate].** Marsh, S.F.; Yarbro, S.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-880903—1). NTIS, PC A02. Order Number DE88009114/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

The more-than-adequate extraction of actinides from high nitrate solutions and of efficient back-extraction from low nitrate solutions make DHDECMP the preferred extractant for this application. Isopar-diluted DHDECMP extraction data are presented herein. Comparative extraction data for Am(III) Pu(IV), and U(VI) are also presented. The behavior of these three actinides can be assumed to represent the general behavior of other actinides in their trivalent, tetravalent, and hexavalent oxidation states. 4 refs., 5 figs.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 48279, 50268

48197 **(PNL—6524) Fuel consolidation demonstration program: Methods development, testing, and design analyses: Interim report.** (Pacific Northwest Lab., Richland, WA (USA); Electric Power Research Inst., Palo Alto, CA (USA); Combustion Engineering, Inc., Windsor, CT (USA)). Aug 1988. Contract AC06-76RL01830. 164p. (EPRI-NP—5945). NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88015835/JAW.

EPRI, Northeast Utilities, the US Department of Energy, Baltimore Gas and Electric, and Combustion Engineering are engaged in a program to develop a spent fuel consolidation system licensed by the US Nuclear Regulatory Commission. Fuel consolidation offers a means of substantially increasing the capacity of spent fuel storage pools. Consolidation equipment design, development, fabrication, and testing are being performed by combustion Engineering in windsor, Connecticut. Seismic and structural evaluation of the capability of the Millstone Unit 2 spent fuel pool and building to accommodate the increased fuel capacity is being conducted by Northeast Utilities. Northeast Utilities plans to obtain a license amendment to permit storage of consolidated spent fuel at Millstone Unit 2. Additionally, NU intends to perform a hot demonstration of the integrated consolidated system equipment with spent fuel at Millstone Unit 2. The spent fuel storage system designs were analyzed to show that they meet the Nuclear Regulatory Commission licensing criteria for subcriticality. Results from the criticality experiments on spent fuel rod arrays were used in the development of an analytical computer model for consolidated spent fuel characteristics. 41 refs., 62 figs., 20 tabs.

48198 **(UCRL—52000-88-6) Energy and technology review.** Poggio, A.J. (ed.). (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015833/JAW.

This issue contains three articles: Transporting Spent Reactor Fuel Safety, Shipping Cask Analysis System, and Computer-Aided Information Science and the Intelligent Gateway Processor. Each article gives a brief description of the research project with

the nontechnical reader in mind. Information contacts for each project are given. (DWL)

0520 Waste Management

REFER ALSO TO CITATION(S) 48190, 48197, 48308, 48329, 49111, 49149, 49171, 49221, 49475, 49565, 49568, 49607, 49610, 49611, 50268

48199 (AD-A—193186/4/XAB) Recommendations to the NRC (Nuclear Regulatory Commission) for review criteria for alternative methods of low-level radioactive waste disposal. Task 2B. Earth-mounded concrete bunkers. Final report. Denson, R.H.; Bean, D.L.; Ainsworth, D.L.; Bennett, R.D.; Wamsley, R.M. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Structures Lab.). Jan 1988. 126p. (WES/MP/SL—88-4-2B). NTIS, PC A07/MF A01.

Also available as NUREG/CR-5041-VOL-2.

The U.S. Army Engineers Waterways Experiment Station and U.S. Army Engineer Division, Huntsville, have developed general design criteria and specific design review criteria for the earth-mounded concrete bunker (EMCB) alternative method of low-level radioactive waste disposal. An EMCB is generally described as a reinforced concrete vault placed below grade, underneath a tumulus, surrounded by filter-blanket and drainage zones. The tumulus is covered over with a low permeability cover layer and top soil with vegetation. Eight major review criteria categories have been developed ranging from the loads imposed on the EMCB structure through material quality and durability considerations. Specific design review criteria have been developed in detail for each of the eight major categories.

48200 (BMI/ONWI/C—146(1)) Design parameters and source terms: Volume 1, Design parameters: Revision 0. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA). Advanced Technology Div.). Sep 1987. Contract AC02-87CH10290;AC02-83WM46656. 436p. H. Order Number DE88015043/JAW.

The Design Parameters and Source Terms Document was prepared in accordance with DOE request and to provide data for the environmental impact study to be performed in the future for the Deaf Smith County, Texas site for a nuclear waste repository in salt. This document updates a previous unpublished report to the level of the Site Characterization Plan - Conceptual Design Report, SCP-CDR. The previous unpublished SCC Study identified the data needs for the Environmental Assessment effort for seven possible salt repository sites.

48201 (BMI/ONWI/C—146(2)) Design parameters and source terms: Volume 2, Source terms: Revision 0. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA). Advanced Technology Div.). Sep 1987. Contract AC02-87CH10290;AC02-83WM46656. 307p. H. Order Number DE88015044/JAW.

The Design Parameters and Source Terms Document was prepared in accordance with DOE request and to provide data for the environmental impact study to be performed in the future for the Deaf Smith County, Texas site for a nuclear waste repository in salt. This document updates a previous unpublished report to the level of the Site Characterization Plan—Conceptual Design Report SCP-CDR. The previous study identifies the data needs for the Environmental Assessment effort for seven possible salt repository sites. Volume 2 contains tables of source terms.

48202 (BMI/ONWI/C—146(3)) Design parameters and source terms: Volume 3, Source terms: Revision 0. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA). Advanced Technology Div.). Sep 1987. Contract AC02-87CH10290;AC02-83WM46656. 372p. H. Order Number DE88015045/JAW.

The Design Parameters and Source Terms Document was prepared in accordance with DOE request and to provide data for the environmental impact study to be performed in the future for the Deaf Smith County, Texas site for a nuclear waste repository in salt. This document updates a previous unpublished report to the level of the Site Characterization Plan {endash} Conceptual Design Report, SCP-CDR. The previous unpublished SCC Study identifies the data needs for the Environmental Assessment effort for seven possible salt repository sites.

48203 (BMI/ONWI/C—149) Preliminary petrological and geochemical results from the Salton Sea Geothermal Field, California: A near-field natural analog of a radioactive waste repository in salt: Topical report No. 2. Elders, W.A.; Cohen, L.H.; Williams, A.E.; Neville, S.; Collier, P.; Oakes, C. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; California Univ., Riverside (USA). Inst. of Geophysics and Planetary Physics). Mar 1986. Contract AC02-87CH10290;AC06-76RL01830;AC02-83CH10140. 187p. (UCR/IGPP—84/12). H. Order Number DE88014892/JAW.

High concentrations of radionuclides and high temperatures are not naturally encountered in salt beds. For this reason, the Salton Sea Geothermal Field (SSGF) may be the best available geologic analog of some of the processes expected to occur in high level nuclear waste repositories in salt. Subsurface temperatures and brine concentrations in the SSGF span most of the temperature range and fluid inclusion brine range expected in a salt repository, and the clay-rich sedimentary rocks are similar to those which host bedded or domal salts. As many of the chemical processes observed in the SSGF are similar to those expected to occur in or near a salt repository, data derived from it can be used in the validation of geochemical models of the near-field of a repository in salt. This report describes preliminary data on petrology and geochemistry, emphasizing the distribution of rare earth elements and U and Th, of cores and cuttings from several deep wells chosen to span a range of temperature gradients and salinities. Subsurface temperature logs have been augmented by fluid inclusion studies, to reveal the effects of brines of varying temperature and salinity. The presence of brines with different oxygen isotopic signatures also indicate lack of mixing. Whole rock major, minor and trace element analyses and data on brine compositions are being used to study chemical migration in these sediments. 65 refs., 20 figs., 3 tabs.

48204 (BMI/ONWI/C—150) Repository design data needed from site characterization. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA). Advanced Technology Div.). Feb 1988. Contract AC02-87CH10290;AC02-83WM46656. 189p. H. Order Number TI88014897/JAW.

This document establishes the data needed from site characterization for the salt repository Architect/Engineer (A/E) design. Data needs are correlated with design activities on a matrix to identify data need categories pertinent to the various design activities. Each data need category is described in some detail on a separate sheet that describes the data need, why the data are needed, some information on potential data collection methodology, and described A/E data accuracy requirements. A response form is provided for the data gatherer to submit data in a format similar to the data need forms. Use of and rationale for the matrix, data need forms, and data need response forms are discussed in introductory text. 171 refs.

48205 (BMI/ONWI/C—157) In situ testing data management plan. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Golder Associates, Inc., Redmond, WA (USA)). Aug 1987. Contract AC02-87CH10290. 132p. NTIS, PC A06. Order Number DE88014900/JAW.

The data management task will provide an interface between the data generating activities of the underground testing contractor and the Office of Nuclear Waste Isolation (ONWI). The interface will provide a means for the transfer of data from the underground testing personnel to the Data Management Group (DMG) and then to the ONWI Information Management Department. The Data Management Plan (DMP) will assure that timely turnover packages are complete and properly documented, that data formats and terminology meet ONWI requirements, and that adequate records of

data and distribution are maintained. In addition, the DMP will ensure that approved storage facilities are maintained for original and authenticated duplicate data and that approved procedures are developed for the receipt, handling, storage, and turnover of data. 2 refs., 23 figs., 11 tabs.

48206 **(BMI/ONWI/C—158) Decontamination techniques applicable to waste packages: Final report.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA). Advanced Technology Div.). Mar 1988. Contract AC02-87CH10290;AC02-83WM46656. 69p. H. Order Number TI88014899/JAW.

This report presents an evaluation of methods for decontamination of reference waste canisters and waste containers. The potential use of chemical solvents, ultrasonics, liquid abrasive blasting, vibratory finishing, electropolishing, liquid honing, high-pressure steam/water spraying, and fixatives as decontamination techniques for outer waste package and canister surfaces is discussed. Either test results or available literature on these techniques were examined to assess applicability of the methods. Pertinent technical considerations for each method are presented and discussed. Electropolishing and liquid abrasive blasting are the processes recommended for remote decontamination of waste overpacks and canisters. These processes are recommended on the basis of a number of factors including the type of contaminants present; the geometric configurations and materials; the accessibility, size, and mass of the units; and the time available to perform the process. Representative process conceptual designs for electropolishing and liquid abrasive blasting are presented in this report. Major equipment items and process operations are discussed. Secondary waste treatment and disposal requirements are also briefly discussed. 16 refs., 7 figs., 4 tabs.

48207 **(BMI/ONWI/C—159) Site study plan for Deep Hydronest Test Wells, Deaf Smith County Site, Texas: Preliminary draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). May 1987. Contract AC02-87CH10290. 74p. H. Order Number TI88014893/JAW.

Wells called Deep Hydronest Wells will be installed at six locations at the Deaf Smith County Site to characterize hydraulic parameters in the geologic column between the top of the San Andres Formation and the base of Pennsylvanian System. Three hydronests will be drilled during early stages of site characterization to provide data for performance assessment modeling. Four wells are proposed for each of these 3 nests. Results of drilling, testing, and preliminary modeling will direct drilling and testing activities at the last 3 nests. Two wells are proposed at each of the last 3 nests for a total of 18 wells. The Salt Repository Project (SRP) Networks specify the schedule under which this program will operate. Drilling and hydrologic testing of the first Deep Hydronest will begin early in the Surface Investigation Program. Drilling and testing of the first three Deep Hydronests will require about 18 months. After 12 months of evaluating and analyzing data from the first three hydronests, the remaining three hydronests will be drilled during a 12-month period. The Technical Field Services Contractor is responsible for conducting the field program. Samples and data will be handled and reported in accordance with established SRP procedures. A quality assurance program will be used to assure that activities affecting quality are performed correctly and that the appropriate documentation is maintained. 36 refs., 20 figs., 6 tabs.

48208 **(BMI/ONWI/C—166) Final environmental and regulatory assessment of using asphalt as a sealant in mine shafts.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Parsons Brinckerhoff, Houston, TX (USA); NEOS Corp., Lafayette, CA (USA)). 1987. Contract AC02-87CH10290. 185p. H. Order Number DE88015656/JAW.

This report discusses the properties of asphalt, the current regulatory status governing asphalt and future regulatory implications which may be pertinent in using asphalt as a waterproof shaft sealant. An understanding of the inherent organic composition of asphalt, an increase in the number of health and environmental research publications conducted on asphalt and an examination of the apparent trend of regulatory agencies toward more stringent environmental regulation governing the use of organic materials suggests asphalt could become regulated at a future time. This would only occur, however, if asphalt was found to conform to the present regulatory definitions of pollutants, contaminants or hazardous substances or if asphalt was included on a regulated substance list. In this regard, the study points out that asphalt contains very low levels of hazardous poly-nuclear aromatics (PNA's). These levels are significantly lower than the levels present in coal tars, a substance known to contain high levels of hazardous PNA's. Asphalt, however, has the inherent potential of producing higher concentrations of PNA's if the adverse condition of cracking should occur during the refinery production stage or on-site preparation of the asphalt. Also, unless existing control technology is applied, emission levels of sulfur dioxide, carbon monoxide, particulates and volatile organic carbons from the on-site preparation facilities could approach the permissible health standard levels of EPA. The study indicates, however, that available literature is limited on these issues.

48209 **(BMI/ONWI/C—170) ESF [exploratory shaft facility] title 2 90% design review findings report.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). [1988]. Contract AC02-87CH10290. 478p. H. Order Number DE88015654/JAW.

The document includes facilities, systems, component design along with specifications and drawings at the Title II design level. This is part of technology transfer activity.

48210 **(BMI/ONWI/C—174) SALT5: A two-dimensional displacement discontinuity code for analysis of nuclear waste repositories in bedded salt deposits.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Minnesota Univ., Minneapolis (USA). Dept. of Civil and Mineral Engineering). Sep 1985. Contract AC02-87CH10290. 241p. H. Order Number TI88015655/JAW.

SALT5 is a two-dimensional displacement discontinuity code designed to evaluate temperatures, deformations, and stresses associated with underground emplacement of radioactive waste in bedded salt. It has the capability of simulating the step by step creation of underground excavations in seam-type deposits by changing the boundary conditions in the displacement discontinuity method. The emplacement of nuclear waste canisters in the floor of the excavations is modeled using constant or exponentially decaying lime heat sources. These heat sources are assigned various cooling periods to account for the time that the waste has been out of the reactor prior to burial. SALT5 is a two-dimensional plane strain model. As a result, excavations and heat sources are assumed to extend to infinity in the direction perpendicular to the plane of analysis. SALT5 also simulates the earth's surface, modeling it as an isothermal, traction-free boundary. Because SALT5 is based on linear elasticity, the principle of superposition holds, and the total stresses and displacements are obtained by summing the in situ (prior to mining), thermo-elastic, and excavation induced values. This report gives the underlying theory for the SALT5 code and documents its accuracy by comparing its results with verification, benchmark and validation problems. 15 refs., 33 figs., 23 tabs.

48211 **(BMI/ONWI/C—179) Report of liquid permeability measurements on rock core samples from Mansfield No. 1 Well, Permian Basin project.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Stone and Webster Engineering Corp., Boston, MA (USA)). 26 Feb 1985. Contract AC02-87CH10290;AC02-87CH10285. 47p. H. Order Number TI88015664/JAW.

This report presents the results of the measurements on specimens from the Mansfield No. 1 Well, and it describes in some detail the apparatus and procedure used for the measurements to assist the reader in understanding how they were made. Where unusual specimen responses were encountered, the data reflecting the responses are presented and explanations offered. Finally, evaluations are made of both the results and the apparatus and procedure. 4 refs., 13 figs.

48212 **(BMI/ONWI/C—181) Repository shafts relocation study: Final report.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA)). Feb 1988. Contract AC02-87CH10290;AC02-83WM46656. 54p. H. Order Number TI88015800/JAW.

This study was undertaken to reconfigure the sub-surface layout so as to move the shaft pillar out of the area of the probable maximum flood (PMF). The reconfiguration consisted of two major changes in the layout. First, two emplacement entries at the south end of the repository were moved into an area west of the shaft pillar. Secondly, the width of the shaft pillar was reduced from 1800 ft to 1200 ft. This change was based on more detailed scoping studies than had been conducted during SCP-CD. Finite element analysis and calculation of shaft pillar size by empirical methods, data evaluation from operating evaporite mines, thermomechanical analysis, and review of damaged mine shafts all went into this scoping study. It was assumed that there are tolerable vertical and horizontal displacements to shaft linings and surface facilities and that these structures can be designed and constructed to withstand these deformations. In a preliminary revised underground layout, the exploratory shafts (ESs) were 369 ft west of the locations identified in the Draft Environmental Assessment (DEA). However, there was a desire to keep them in the DEA, hence the final Environmental Assessment (EA, DOE, 1986), locations. This was accomplished by moving shaft A and its connecting entries 625 ft to the east and making certain other modifications to the layout. This change would require excavating an additional 40,000 tons of salt and a 1.2 month extension of pre-emplacement development activity. 12 ref., 19 figs., 3 tabs.

48213 **(BMI/ONWI/C—183) Site study plan for Exploratory shaft facilities design foundation boreholes (shaft surface facility foundation borings), Deaf Smith County Site, Texas: Surface-based geotechnical field program: Preliminary draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Dec 1987. Contract AC02-87CH10290. 65p. H. Order Number TI88015804/JAW.

This site study plan describes the Exploratory Shaft Facilities (ESF) Design Foundation Boreholes field activities to be conducted during early stages of Site Characterization at the Deaf Smith County, Texas, site. The field program has been designed to provide data useful in addressing information/data needs resulting from federal/state/local regulations, and repository program requirements. Approximately 50 foundation boreholes will be drilled within the ESP location to provide data necessary for design of the ESF and to satisfy applicable shaft permitting requirements. Soils and subsurface rock will be sampled as the foundation boreholes are advanced. Soil samples or rock core will be taken through the Blackwater Draw and Ogallala Formations and the Dockum Group. Hydrologic testing will be performed in boreholes that penetrates the water table. In-situ elastic properties will be determined from both the soil strata and rock units along the length of the boreholes. Field methods/tests are chosen that provide the best or only means of obtaining the required data. The Salt Repository Project (SRP) Networks specify the schedule under which the program will operate. Drilling will not begin until after site ground water baseline conditions have been established. The Technical Field Services Contractor is responsible for conducting the field program of drilling and testing. Samples and data will be handled and reported in accordance with established SRP procedures. A quality assurance program will be utilized to assure that activities affecting quality are performed correctly and that the appropriate documentation is maintained. 25 refs., 10 figs., 6 tabs.

48214 **(BMI/ONWI/C—185) Site study plan for exploratory shaft monitoring wells, Deaf Smith County Site, Texas: Preliminary Draft.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jan 1988. Contract AC02-87CH10290. 88p. H. Order Number TI88014894/JAW.

As part of site characterization studies, two exploratory shafts will be constructed at the Deaf Smith County site, Texas. Twelve wells at five locations have been proposed to monitor potential impacts of shaft construction on water-bearing zones in the Ogallala Formation and the Dockum Group. In addition, tests have been proposed to determine the hydraulic properties of the water-bearing zones for use in design and construction of the shafts. Samples of the Blackwater Draw Formation, Ogallala Formation, and Dockum Group will be obtained during construction of these wells. Visual indentification, laboratory testing, and in situ testing will yield data necessary for Exploratory Shaft Facility design and construction. This activity provides the earliest data on the Blackwater Drew Formation, Ogallala Formation, and Dockum Group near the exploratory shaft locations. Drilling and hydrologic testing are scheduled prior to other subsurface activity at the Exploratory Shaft Facility to establish ground-water baseline conditions. The Technical Field Services Contractor is responsible for conducting the field program of drilling and testing. Samples and data will be handled and reported in accordance with established Salt Repository Project procedures. A quality assurance program will be utilized to assure that activities affecting quality are performed correctly and that the appropriate documentation is maintained. 45 refs., 11 figs., 4 tabs.

48215 **(BMI/ONWI/C—186-Vol.2) 90% review technical specifications, Deaf Smith Site: Volume 2.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Parsons Brinckerhoff, Houston, TX (USA)). Jan 1988. Contract AC02-87CH10290;AC97-86WM46664. 675p. H. Order Number DE88014891/JAW.

This document contains only the detailed specifications that were to apply to the construction of the repository.

48216 **(BMI/ONWI/C—188-Rev.2) Evaluation of air quality and noise impact assessments, Davis Canyon.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). May 1986. Contract AC02-87CH10290. 1508p. (BMI/ONWI—683-Rev.2). H; 3; GPO Dep. Order Number DE88015024/JAW.

In this report, several issues are identified regarding the air quality and noise assessments presented in the final salt repository environmental assessment (EA) prepared by the US Department of Energy for the Davis Canyon, Utah, site. Necessary revisions to the data and methods used to develop the EA impact assessment are described. Then, a comparative evaluation is presented in which estimated impacts based upon the revised data and methods are compared with the impacts published in the EA. The evaluation indicates that the conclusions of the EA air quality and noise impact sections would be unchanged. Consequently, the guideline findings presented in Chapter 6 of the EA are also unchanged by the revised analysis. 50 refs., 16 tabs.

48217 **(BMI/ONWI/C—189) Potential noise impact from proposed operations at the Davis Canyon, Utah site: Evaluation of atmospheric acoustic refractive index profiles: Task 1, Final report.** Thomson, D.W. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1 Oct 1986. Contract AC02-87CH10290. 166p. H. Order Number DE88014901/JAW.

This study was motivated by the need to assess whether or not there would be significant noise impact from a proposed industrial operation to be sited in Davis Canyon, Utah. Completion of the study required improving several aspects of our fundamental understanding of atmospheric sound propagation and analysis of a diverse set of meteorological measurements which pertained specifically to the Davis Canyon location. The above two "generic" and "specific" objectives were sufficiently different that this final report has been divided into two parts. The first, generic, portion was prepared because neither existing noise standards nor standard field measurement techniques adequately recognize the importance of normal atmospheric boundary layer structure and processes on the magnitude and variations of noise propagated out-of-doors. The second, specific, part of the report summarizes a variety of acoustically-oriented analyses of meteorological measurements made near Davis Canyon. The results in both parts of the report are based on sophisticated atmospheric analysis, boundary layer and propagation models. The presentation of time dependent "maps" of predicted sound pressure levels (also as a function of frequency and source-

surrounding topography) represents a significant advance in the state-of-the-art of environmental noise analysis and prediction.

48218 **(BMI/ONWI/C—190) Preliminary analysis of the operating characteristics of a generic repository receiving facility: Status report.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Oct 1985. Contract AC02-87CH10290. 61p. H. Order Number DE88015663/JAW.

The operating characteristics of a repository receiving facility structured around current technology and practices have been reviewed. Cask turnaround times and operator doses were estimated. Large throughout and long-term receiving operations at a nuclear waste repository result in an unprecedented number of casks being handled. While the current generation of material-handling equipment is adequate to process the casks, personnel radiation exposures for the generic facility analyzed are unacceptably high. This emphasizes the need for development of occupational radiation exposure control concepts for application in repository receiving facilities. 3 refs., 22 figs., 6 tabs.

48219 **(BMI/ONWI/C—192) Trend analysis and data evaluation report BPMD quality assurance program: July 1, 1986--June 30, 1987.** Ailes, S.B. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1988. Contract AC02-87CH10290. 35p. OSTI, PO Bx 62, Oak Ridge, TN 3783103. Order Number TI88015665/JAW.

This report contains a trend analysis and other evaluation of data conducted on deficiency and corrective action data collected during the period of July 1, 1986, through June 30, 1987. The data collected form Audit Action Reports, Management and Contractor Corrective Action Requests, and Deficiency Notices were evaluated to identify whether adverse quality trends were developing. An evaluation of quality trend data identified a suspected adverse condition related to an apparently high incidence of deficiencies related to NQA-1 Requirements for instructions, Procedures, and Drawings for BPMD contractor and DOE prime and integrated QA programs. Further evaluation of the data indicated that no adverse quality trend appears to exist; multiple deficiency reports were issued for the same system problem. This skewed the data, indicating a higher level of incidence of a deficiency type than actually existed. The Corrective Action Tracking System, now being developed, will provide management with real time comparison of trend data for use in reducing the possibility for the multiple reporting of the same deficiency. Although the average closure time for DOE prime and integrated contractor deficiencies is 235 days, the data in Figure A-6 indicates an improvement (reduction) in the closure time. As the timeliness of corrective action is impacted by how long deficiencies remain open, deficiency closure performance will be monitored during the next reporting period. 15 figs.

48220 **(BMI/ONWI/C—197) Site study plan for EDBH [Engineering Design Boreholes] No. 1 and 2: Revision 1.** (Battelle Memorial Inst., Columbus, OH (USA)). Dec 1987. Contract AC02-87CH10290. 61p. H. Order Number DE88015661/JAW.

This site study plan describes the Engineering Design Boreholes 1 and 2 field activities to be conducted during early stages of Site Characterization at the Deaf Smith County site, Texas. The field program has been designed to provide data useful in addressing information/data needs resulting from federal/state/local regulations and repository program requirements. A borehole will be drilled at the centerline of each of the planned exploratory shaft locations. The subsurface rock and fluids will be sampled as the boreholes are advanced to total depth of about 2600 ft. Continuous rock core will be taken below the base of the Dockum Group. Hydrologic testing will occur in units thought to be water bearing and in units of particular interest for shaft seals. Field methods/tests are chosen that provide the best or only means of obtaining the required data. The Salt Repository Project (SRP) Networks specify the schedule under which the program will operate. Drilling will not begin until after site ground-water baseline conditions have been established. The Technical Field Services Contractor is responsible for conducting the field program of drilling and testing. Samples and data will be handled and reported in accordance with established SRP procedures. A quality assurance program will be utilized to assure that activities affecting quality are performed correctly and that the appropriate documentation is maintained. 28 refs., 10 figs., 4 tabs.

48221 **(BMI/ONWI/C—202) Reference list, Deaf Smith County Site Characterization Plan consultation draft.** Root, J.; Moore, N. (comps.). (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jan 1988. Contract AC02-87CH10290. 130p. H. Order Number TI88015803/JAW.

This document is limited to the several hundred veterences used to compile the site characterization plan. (TEM)

48222 **(BMI/ONWI/C—209) Surface feature characterization test plan: Conceptual design of a high level nuclear waste repository in salt.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Engineers, Inc., Irvine, CA (USA). Advanced Technology Div.). Jun 1984. Contract AC02-87CH10290. 42p. H. Order Number DE88015798/JAW.

This report presents the Surface Feature Characterization Test Plan for conceptual design. The Test Plan is part of the surface feature characterization program for conceptual design which will obtain information on site topography, hydrology, stratigraphy, and soil and rock engineering properties. The information will be obtained by the Geologic Project Manager (GPM). This Test Plan provides guidance to the GPM as to (1) the kinds of data to be collected, (2) anticipated methods, (3) the level of detail required, (4) interpretation to be made, and (5) the format for presentation. Based on this Test Plan and on conditions at the site that is selected, the GPM will develop an Activity Plan describing the methods to be used in obtaining the needed information. For each item of information, the Test Plan describes those facilities which require it for their design. The GPM can then determine the appropriate methods and level of effort for obtaining the information, taking into account its use and conditions at the selected site. 7 figs., 3 tabs.

48223 **(BMI/ONWI/C—217) ERG review of waste package corrosion mechanisms.** Geisert, R.E. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1988. Contract AC02-87CH10290. 18p. H. Order Number TI88015801/JAW.

The Engineering Review Group (ERG) was established by the Office of Nuclear Waste Isolation (ONWI) to help evaluate engineering-related issues in the US Department of Energy's nuclear waste repository program. The ERG reviewed the waste package corrosion mechanisms. This report documents the ERG's comments and recommendations on these subjects and the ONWI response to the specific points raised by the ERG. 1 ref.

48224 **(BMU—1987-170) Differences between the U.S. American and German strategies for ultimate disposal of radioactive waste. Results of a German-American meeting for exchange of experience, March 9-19, 1987.** Baltes, B.; Gruendler, D.; Holzhauer, U.; Mielke, H.; Wurtinger, W. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.); Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.)). May 1987. 43p. (In German). (GRS-A—1355). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

The report summarizes the results of the meeting by comparing main aspects of the strategies and the conditions in the two countries. The aspects discussed are operational safety analysis programmes for repositories, repository design and performance analysis, waste package design and performance testing, long-term, post closure and safety assessment for LAW, TRU, HAW, and spent fuel. The meeting gathered representatives of the BMU/GRS and of the Office of Civilian Radioactive Waste Management (OCRWM) of the DOE.

48225 **(CONF-860905—Vol.1) Spectrum '86: Proceedings: Volume 1.** Pope, J.M.; Leonard, I.M.; Mayer, E.J. (eds.). (American Nuclear Society. Fuel Cycle and Waste Management Div.; American Nuclear Society. Niagara-Finger Lakes Section). Jul 1987. 1,095p. NTIS, PC A99/MF A01; 1; GPO Dep. Order Number DE88015081/JAW.

From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, NY, USA (14 Sep 1986).

This document, Volume 1 of two, contains 100 papers on various aspects of Radioactive Waste Management. Session topics include: nuclear success stories; low-level waste-grout; filtration and ion exchange, qualification, and pretreatment; solid waste treatment{endash}special grouts, and incineration; equipment design{endash}remote technology, and special equipment; high-level waste{endash}international vitrification projects, plans and system testing, product performance, meltor and product testing, off-gas behavior and processing. Individual reports were processed separately for the data bases. (TEM)

48226 **(CONF-860905—Vol.2) Spectrum '86: Proceedings: Volume 2.** Pope, J.M.; Leonard, I.M.; Mayer, E.J. (eds.). (American Nuclear Society. Fuel Cycle and Waste Management Div.; American Nuclear Society. Niagara-Finger Lakes Section). Jul 1987. 1,088p. NTIS, PC A99/MF A01; 1; GPO Dep. Order Number DE88015082/JAW.

From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, NY, USA (14 Sep 1986).

This document, Volume 2, contains 96 papers on various aspects of radioactive waste management. Session topics include decontamination and decommissioning{endash}industry experience, characterization and safety, techniques, facility and plant decontamination; TRU waste management; regulatory aspects; economics; environmental issues and impacts; construction, operation, and maintenance. Individual papers were processed separately for the data bases. (TEM)

48227 **(CONF-880850—3) A natural language interface to relational data bases for waste management.** Osborne-Lee, I.W.; Rodgers, B.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015294/JAW.

From American Institute of Chemical Engineers summer national meeting; Denver, CO, USA (21 Aug 1988).

INTELLECT(TM) for Rdb/VMS is a natural language system for data base access which runs under the VAX/VMS operating system. It allows English language query, report formatting, and data updates to Rdb/VMS relational databases. INTELLECT translates English requests into database commands, and allows non-technical users to perform a variety of retrieval and processing tasks for decision support or data maintenance using conversational English. The heart of an INTELLECT application is the lexicon, a dictionary of common English words. Initially, the INTELLECT lexicon has about 400 basic words. Customization of this lexicon, including definition of new vocabulary, the basic step in the development of an INTELLECT application. An application of INTELLECT for an Rdb/VMS waste management database was developed. The database, which consists of waste stream characterization and waste management practice information for solid low-level radioactive wastes generated at the three Department of Energy plants in Oak Ridge, is used in disposal resource development and alternatives evaluation. An account of our experience using INTELLECT with the low-level waste management database is given, including the process of lexicon building. The usefulness of the natural language interface in this context is discussed. 13 refs.

48228 **(CONF-880903—3) Consolidation and disposal of nuclear test debris at the Nevada Test Site.** Neagle, C.C.; Dodge, R.L. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). 1988. Contract AC08-84NV10327. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010559/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

Numerous operational activities conducted at the Nevada Test Site (NTS) resulted in 24 fenced-off areas containing radioactively- contaminated debris. The debris consists of structural tower components, building debris, earthen materials, and equipment contaminated during atmospheric and underground testing of nuclear devices. Contaminated materials were consolidated, covered with clean fill, and fenced to reduce the area requiring controlled access and to provide additional radiation safety barriers. In 1980 disposal of the consolidated debris in subsidence craters, formed as a result of underground nuclear testing, was initiated. The waste materials are disposed using conventional landfill techniques where each layer of debris is covered with clean fill before additional waste materials are disposed. The waste is placed to within 3 m of the land surface and backfilled with compacted earthen material to the original grade.

48229 **(CONF-880903—4) Monitoring methods used at the Radioactive Waste Management Site at the Nevada Test Site.** Emer, D.F.; King, K.M. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). 1988. Contract AC08-84NV10327. 2p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010558/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

The state of Nevada has granted permission to dispose of mixed waste (MW) at the NTS. During interim status, MW must be disposed of in an existing pit (Pit 3); there will be no new pit excavated for the disposal of MW prior to state approval; and groundwater monitoring, pit liners, and a moisture monitoring system are not required. However, for the purposes of providing an alternative vadose zone monitoring system for future permitted operations, placement and development of monitoring capabilities is necessary before MW is placed. The preliminary MW monitoring system addresses three areas of concern: downward movement of moisture through the waste, migration of radioactive components, and migration of hazardous components.

48230 **(CONF-880903—5) Defense waste management operations at the Nevada Test Site.** Williams, R.E.; Kendall, E.W. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). 1988. Contract AC08-84NV10327. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010557/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

Waste management activities were initiated at the Nevada Test Site (NTS) to dispose of low-level wastes (LLW) produced by the Department of Energy's (DOE's) weapons testing program. Disposal activities have expanded from the burial of atmospheric weapons testing debris to demonstration facilities for greater-than-Class C (GTCC) waste, transuranic (TRU) waste storage and certification, and the development of a mixed waste (MW) facility. Site specific operational research projects support technology development required for the various disposal facilities. The annual cost of managing the facilities is about $6 million depending on waste volumes and types.

48231 **(CONF-880903—6) Development of a Mixed Waste Management Facility at the Nevada Test Site.** Dodge, R.L.; Brich, R.F. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA); USDOE Nevada Operations Office, Las Vegas). 1988. Contract AC08-84NV10327. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010556/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

The US Department of Energy (DOE) produces radioactive low-level wastes (LLW) which contain hazardous components. Management of those mixed wastes (MW) requires compliance with US Environmental Protection Agency (EPA) regulations for hazardous wastes and DOE regulations for LLW. In 1988, DOE's Nevada Operations Office (NV) began disposing of MW at the Nevada Test Site (NTS) under interim status as authorized by the state of Nevada. MW disposal is limited to Pit 3 while operating under interim status. Preparations for operation of a separate Mixed Waste Management Facility (MWMF) by the end of 1989 are underway. Those preparations include revising the NTS Part B Permit application, developing a MW certification program, devel-

oping and operating a vadose zone monitoring system, preparing an Environmental Assessment (EA), developing protocols for analysis of MW, and facility design and construction. This paper describes the permitting and design of a MWMF at the NTS. This 167-acre facility will be a part of the 732-acre Area 5 Radioactive Waste Management Site (RWMS).

48232 **(CONF-880903—15) Management initiatives to waste management decisions and environmental compliance in Oak Ridge, Tennessee.** Jones, C.G. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 3p. NTIS, PC A02. Order Number DE88011410/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

Martin Marietta Energy Systems, Inc. (MMES) has been the operating contractor for the nuclear production and research facilities at Oak Ridge, Tennessee and Paducah, Kentucky for about four and one-half years. Environmental compliance, regulatory interaction, and public confidence have been very significant issues during this time. This presentation will review the environmental situation in Oak Ridge in 1984 and will discuss management initiatives and experience in the development and implementation of effective environmental and waste management and health and safety programs committed to the protection of the environment, our workers and the public with an overall goal of full compliance with all current and anticipated regulations.

48233 **(CONF-880903—16) Charging generators for waste management costs.** Berry, J.B.; Homan, F.J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011413/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

Implementation of a plan to charge waste management costs to the facility that generates such waste requires a long-term commitment and consistent administration. The benefit is that generators are provided the incentive to optimize waste management practices if the charges are appropriately applied. This paper summarizes (1) a plan to charge waste generators, (2) the administrative structure of the plan, (3) a comparison between the rate structure and changes in waste disposal operations, and (4) issues that have surfaced as the plan is implemented. 2 refs., 1 fig., 1 tab.

48234 **(CONF-880903—17) Performance testing of blast furnace slag for immobilization of technetium in grout.** Gilliam, T.M.; Spence, R.D.; Evans-Brown, B.S.; Morgan, I.L.; Shoemaker, J.L.; Bostick, W.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011411/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

This paper presents preliminary results of a grout development effort to identify grout formulas that can satisfactorily sequester ^{99}Tc contained in an existing Portsmouth Gaseous Diffusion Plant waste. Technetium is of particular concern to the US Nuclear Regulatory Commission (NRC) because of its mobility and biological activity. The mobility of technetium results in large part from the movement of the pertechnate anion [prevalent in low-level radioactive waste (LLW)] through soil and geologic strata with little or no interaction with the surrounding matrix. Ground blast furnace slag has been shown to improve the leach resistance of cement-based waste forms, particularly in regard to technetium. This improved performance has been attributed to fewer and smaller pores in the solidified slags (versus a neat cement paste) and to the reduction of the pertechnate ion to a less soluble form. 9 refs., 2 tabs.

48235 **(CONF-880903—18) Treatment of ORNI process waste.** Berry, J.B.; Brown, C.H. Jr.; Fowler, V.L.; Robinson, S.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02. Order Number DE88011412/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

Because of the shutdown of the hydrofracture process at ORNL, intensive efforts were made to reduce contaminated liquid waste generation rates. Treatment of slightly radioactive process waste has been dramatically improved. The volume of secondary, radioactively contaminated waste streams and the concentration of pollutants discharged to the environment have been reduced. Further improvements, based on results of research and development, are planned. The future value of alternative flowsheets will be compared with process flexibility to determine the optimal upgrade to the treatment plant. 1 ref., 4 figs., 2 tabs.

48236 **(DOE/CH/10140—03(87-2)) Salt Repository Project technical progress report for the quarter 1 January--31 March 1987.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Mar 1988. Contract AC02-87CH10290. 117p. (BMI/ONWI/C—194). H. Order Number TI88015795/JAW.

This document reports the progress being made each quarter on the development of a geologic repository in salt for the permanent disposal of high-level nuclear waste. The reporting elements are arranged by the work breakdown structure so that related studies are presented together. The studies are reported by the Office of Nuclear Waste Isolation, a prime contractor of the US Department of energy (DOE) Salt Repository Project Office. The studies include work by other DOE prime contractors and by contractors to the Office of Nuclear Waste Isolation. 23 refs., 1 fig.

48237 **(DOE/CH/46656—12) Repository design sensitivity study: Engineering study report.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA)). 13 Aug 1987. Contract AC02-87CH10290;AC02-83WM46656. 698p. (BMI/ONWI/C—94). H. Order Number DE88014896/JAW.

A preliminary sensitivity study of the salt repository design has been performed to identify critical site and design parameters to help guide future site characterization and design optimization activities. The study considered the SCP-conceptual design at the Deaf Smith County site in Texas with the horizontal waste package emplacement mode as the base case. Relative to this base case, parameter variations were compared. Limited studies were performed which considered the vertical emplacement mode geometry. The report presents the reference data base and design parameters on which the study was based (including the range of parameters that might be expected). Detailed descriptions of the numerical modeling methods and assumptions are included for the thermal, thermomechanical and hydrogeological analyses. The impacts of parameter variations on the sensitivity of the rock mass response are discussed. Recommendations are provided to help guide site characterization activities and advanced conceptual design optimization activities. 47 refs., 119 refs., 22 tabs.

48238 **(DOE/CH/46656—13) Monitored retrievable storage (MRS) facility and salt repository integration: Engineering study report.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA)). Jul 1987. Contract AC02-87CH10290;AC02-83WM46656. 441p. (BMI/ONWI/C—22). H. Order Number TI88014898/JAW.

This MRS Facility and Salt Repository Integration Study evaluates the impacts of an integrated MRS/Salt Repository Waste Management System on the Salt Repository Surface facilities' design, operations, cost, and schedule. Eight separate cases were studied ranging from a two phase repository design with no MRS facility to a design in which the repository only received package waste from the MRS facility for emplacement. The addition of the MRS facility to the Waste Management System significantly reduced the capital cost of the salt repository. All but one of the cases studied were capable of meeting the waste acceptance data. The reduction in the size and complexity of the Salt Repository waste handling building with the integration of the MRS facility reduces the design and operating staff requirements. 7 refs., 35 figs., 43 tabs.

48239 **(DOE/EA—0363) Shipment of Taiwanese research reactor spent nuclear fuel (Phase 2): Environmental assessment.** (USDOE, Washington, DC). Jun 1988. 86p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88014995/JAW.

The proposed action is to transport approximately 1100 spent fuel rods from a foreign research reactor in Taiwan by sea to Hampton Roads, Virginia, and then overland by truck to the receiving basin for offsite fuels at the Savannah River Plant (SRP) for reprocessing to recover uranium and plutonium. The analysis of the impacts of the proposed action have been evaluated and shown to have negligible impact on the local environments. The calculations have been completed using the RADTRAN III code. PWR spent fuel was analyzed as a benchmark to link the calculations in this analysis to those in earlier environmental documentation. Cumulative total, maximum annual, and per shipment risks were calculated. The results indicate that the PWR spent fuel shipment risks are somewhat lower than those previously estimated. The cumulative and maximum annual normal, or incident-free, risks associated with the shipment of Taiwanese research reactor spent fuel is a factor of 10 lower than that for PWR fuel, and the cumulative and maximum annual accident radiological risks are a factor of about 2.2 lower than that for PWR spent fuel. As a result, the port risks are about a factor of 10 larger than the risk of overland transport. All of the risks calculated are small. The PWR risk values are similar to those judged by the NRC to be small enough not to warrant increased stringency in regulations. The Taiwanese research reactor spent fuel shipment risk values are smaller yet. 51 refs., 22 tabs.

48240 **(DOE/ID—10086(87)) US Department of Energy National Solid Waste Information Management System (NSWIMS): Annual report for calendar year 1987.** Scott, W.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1988. Contract AC07-76ID01570. 71p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88015207/JAW.

The Solid Waste Information Management System (SWIMS) is the database used to gather information for the US Department of Energy (DOE) on DOE and Department of Defense solid low-level radioactive waste (LLW). The National SWIMS Annual Report (NSWIMS) provides officials of the DOE with management information on the entire DOE/defense solid LLW cycle. The acronym for the annual report, NSWIMS, signifies that an improved format has been developed to make this document a more useful tool for assessing solid LLW management performance. Part I provides a composite summary of the DOE/defense solid LLW management. It includes data related to waste generation, forecasting, treatment, and disposal. Part II contains SWIMS computer-supplied information with discussions of the data presented, standardized and simplified data tables, and revised figures. All data are presented without interpretation and are potentially useful to users for evaluating trends, identifying possible problem areas, and defining future implications. 33 figs., 29 tabs.

48241 **(DOE/ID—10183) Subsurface Investigations Program at the Radioactive Waste Management Complex of the Idaho National Engineering Laboratory: Annual progress report, FY-1987.** Laney, P.T.; Minkin, S.C.; Baca, R.G.; McElroy, D.L.; Hubbell, J.M.; Hull, L.C.; Russell, B.F.; Stormberg, G.J.; Pittman, J.T. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1988. Contract AC07-76ID01570. 269p. NTIS, PC A12. Order Number DE88015084/JAW.

The Subsurface Investigations Program is obtaining program objectives of a field calibration of a model to predict long-term radionuclide migration and measurement of the actual migration to date. Three deep boreholes were drilled at the Radioactive Waste Management Complex (RWMC) to collect sample material for evaluation of radionuclide content in the interbeds, to determine geologic and hydrologic characteristics of the sediments, and to provide monitoring sites for moisture movement in these sediments. Suction lysimeters and heat dissipation sensors were installed in two deep boreholes to collect moisture data. Data from the moisture sensing instruments installed at the RWMC continued to be collected during FY-1987. Because of the large volume of collected data, the RWMC Data Management System was developed and implemented to facilitate the storage, retrieval, and manipulation of the database. Work on the Computer Model Development task focused on a detailed review of previous vadose zone modeling studies at INEL, acquisition and installation of a suite of computer models for unsaturated flow and contaminant transport, and preliminary applications of computer models using site-specific data. Computer models installed on the INEL CRAY computer for modeling transport through the subsurface pathway include SEMTRA, FEMTRA, TRACR3D, MAGNUM, and CHAINT. In addition to the major computer models, eight other codes, referred to as support codes and models, have been acquired and implemented. 27 refs., 70 figs., 22 tabs.

48242 **(DOE/ID—12499-1) Interim site management plan for the LLRW [low-level radioactive waste] disposal area at West Valley, New York: Task 4 report, Final report.** Apoldo, L.J.; Raymond, E.; Howard, R. (Envirosphere Co., New York (USA); New York State Energy Research and Development Authority, Albany (USA)). Jan 1986. Contract FG07-84ID12499. 158p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88015211/JAW.

The New York State Energy Research and Development Authority has sponsored a project to develop an integrated set of site management plans for the West Valley low-level radioactive waste (LLRW) disposal area. The plans were directed to upgrade the disposal area so that passive custodial care and monitoring activities would be sufficient to protect public health and safety and the environment. Task 4, the Interim Site Management Plan (ISMP), is the subject of this report. The goal of Task 4 was to develop a coordinated strategy for managing the LLRW disposal area to protect the public health and safety until the achievement of long-term site stabilization. The major objectives of this task included (1) develop a practical and cost-effective ISMP; (2) provide for maintenance activities that ensure compliance with all applicable regulatory and environmental regulations, standards, and guidelines; and (3) propose a data collection and analysis program specifically designed to assess and confirm site stabilization. The proposed ISMP consisted of the following 12 activities: (1) Trench Cap Settlement Monitoring Program; (2) Surface Water Management; (3) Leachate Monitoring and Analysis; (4) Site Surveillance and Maintenance; (5) Site Surveys; (6) Trench Sump; (7) Leachate Pumping and Treating; (8) Trench Cap Reworking; (9) Lagoon Closure; (10) North Slope Stabilization; (11) Demonstration Project; and (12) Site Closure. A summary of this Task 4 report is included in the Task 7 Report, Project Summary.

48243 **(DOE/ID/12499—2) Regulatory analysis and lessons learned from the LLRW [low-level radioactive waste] disposal area at West Valley, New York: Final report.** (Envirosphere Co., New York (USA)). Dec 1986. Contract FG07-84ID12499. 214p. NTIS, PC A10. Order Number DE88015212/JAW.

The New York State Energy Research and Development Authority has sponsored a project to develop an integrated set of site management plans for the West Valley low-level radioactive waste (LLRW) disposal area. The plans were directed to upgrade the disposal area so that passive custodial care and monitoring activities would be sufficient to protect public health and safety and the environment. Tasks 5 and 6, Regulatory Analysis and Lessons Learned, are the subject of this report. The regulatory analysis identified areas of inconsistencies between the historic site operations and the current state and federal LLRW disposal regulations and guidelines. The lessons learned task identified the causes of the disposal problems at West Valley, discussed the lessons learned, and described the responses developed by the NRC and industry to the lessons learned. 85 refs., 6 figs., 19 tabs.

48244 **(DOE/ID/12499—3) Executive summary of the site stabilization study for the LLRW [low-level radioactive waste] disposal area at West Valley, New York: Task 7, Final report.** Apoldo, L.J.; Cannon, R.; Dehmel, J.C.; Eng, R.; Howard, R.; Khoury, S.; Oztunali, O.; Zimmermann, P. (Envirosphere Co., New York (USA); New York State Energy Research and Development Authority, Albany (USA)). Dec 1986. Contract FG07-84ID12499. 99p. NTIS, PC A05. Order Number DE88015234/JAW.

The New York State Energy Research and Development Authority has sponsored a project to develop an integrated set of site management plans for the West Valley low-level radioactive waste (LLRW) disposal area. The plans were directed to upgrade the disposal area so that passive custodial care and monitoring activities would be sufficient to protect public health and safety and the environment. To fulfill the project objectives, the project was organized into tasks; the last of which, Task 7, Project Summary, is the subject of this report. A summary of each project task is described herein. 19 figs., 8 tabs.

48245 **(DOE/LLW—62T) Guidelines for radiological performance assessment of DOE low-level radioactive waste disposal sites.** Case, M.J.; Otis, M.D. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1988. Contract AC07-76ID01570. 143p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88015224/JAW.

This document provides guidance for conducting radiological performance assessments of Department of Energy (DOE) low-level radioactive waste (LLW) disposal facilities. The guidance is specifically intended to provide the fundamental approach necessary to meet the performance assessment requirements. The document is written for LLW facility operators or other personnel who will manage the performance assessment task. The document is meant to provide guidance for conducting performance assessments in a generally consistent manner at all DOE LLW disposal facilities. The guidance includes a summary of performance objectives to be met by LLW disposal facilities (these objectives are derived from current DOE and other applicable federal regulatory guidelines); specific criteria for an adequate performance assessment and from which a minimum set of required calculations may be determined; recommendations of methods for screening critical components of the analysis system so that these components can be addressed in detail; recommendations for the selection of existing models and the development of site-specific models; recommendations of techniques for comparison of assessment results with performance objectives; and a summary of reporting requirements.

48246 **(DOE/RL—88-01) Hazardous waste management plan.** (USDOE Richland Operations Office, WA; Westinghouse Hanford Co., Richland, WA (USA)). Feb 1988. Contract AC06-87RL10930. 160p. NTIS, PC A08. Order Number DE88015600/JAW.

The approach for achieving regulatory compliance as described in this plan entails a seven-step process: (1) define and interpret regulatory criteria for compliance, (2) assess facilities and operations against these criteria, (3) identify areas of noncompliance, (4) identify necessary measures to correct noncompliance, (5) implement the identified measures, (6) ensure that compliance has been attained, and (7) establish measures to maintain compliance. The Hazardous Waste Management Plan will summarize and document the status of both the site-wide and facility-specific compliance efforts. Assessments conducted to date indicate that the handling of nonradioactive hazardous wastes meets the majority of all identified requirements. An important requirement for establishing compliance is to complete the implementation of appropriate routine procedures in facilities where these are applicable. However, establishing compliance in the handling of radioactive hazardous wastes (mixed wastes) requires the revision of current practices. The development and implementation of a formal waste minimization program, contingency and/or emergency plans, and training programs will establish compliance for the waste generating facilities. 8 refs., 12 figs., 9 tabs.

48247 **(DOE/RL—88-07) Hanford Waste Vitrification Plant briefing booklet.** (Westinghouse Hanford Co., Richland, WA (USA)). Mar 1988. Contract AC06-87RL10930. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015615/JAW.

This document contains viewgraphs for a presentation on Hanfords Vitrification Plant. The brief summaries included a description of the plants operation.

48248 **(DOE/WIPP—88-006) 1988 annual water quality data report for the Waste Isolation Pilot Plant.** Randall, W.S.; Crawley, M.E.; Lyon, M.L. (Westinghouse Electric Corp., Carlsbad, NM (USA). Engineering and Repository Technology Dept.). Mar 1988. Contract AC04-86AL31950. 504p. NTIS, PC A22/MF A01; 1; GPO Dep. Order Number DE88015581/JAW.

The Water Quality Sampling Program (WQSP) supports four major programs for the WIPP: Site Characterization, Performance Assessment, the Radiological Baseline Program, and the Ecological Monitoring Program. Results from 24 WQSP wells sampled from January 1987 through November 1987 are presented in this report. Water quality data from two water-bearing zones have been collected. These zones are the Culebra and Magenta Dolomite Members of the Rustler Formation. Analytical results from the sampling program include field chemistry data, general water quality parameters, trace metals, EPA priority pollutants, dissolved gases and selected redox couples. In addition to the 24 WQSP wells mentioned above, 9 private wells were sampled for primary and secondary drinking water parameters and radionuclides. Six wells were analyzed for trace metal concentrations and priority pollutants as well as general water quality parameters and radionuclides. The water samples from the private wells came from three water-bearing zones, the Santa Rosa Sandstone of the Dockum Group, the Dewey Lake Red Beds Formation and the Culebra Dolomite Member of the Rustler Formation. It is hoped that with the continuing search for records and analysis of the water samples the source of the water may be determined. 20 refs., 98 figs., 108 tabs.

48249 **(DP-MS—86-35) Savannah River waste glass performance.** Wicks, G.G. (Savannah River Lab., Aiken, SC (USA)). 1986. Contract AC09-76SR00001. 14p. (CONF-860905—38). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014301/JAW.

From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, NY, USA (14 Sep 1986).

A multi-phase experimental program has been in progress at Savannah River for almost ten years to assess and explain the behavior of glass containing nuclear waste during solidification, transportation, and burial. Borosilicate glass wasteforms have performed superbly under the many conditions studied to date. 23 refs., 5 figs., 5 tabs.

48250 **(DP-MS—86-82) The challenge of DWPF: Remote maintenance.** Fingler, L. (Bechtel National, Inc., San Francisco, CA (USA)). [1988]. Contract AC09-76SR00001. 15p. NTIS, PC A03. Order Number DE88014296/JAW.

This document describes a presentation on the Defense Waste Processing Facility, which is currently under construction at the Savannah River Plant. The author describes the functions of the facility in general terms and addresses the problems of remotely controlled operation, a central feature in its design. The special engineering required for remote servicing is reviewed and the use of scale models in the initial stages is discussed. 10 figs.

48251 **(DP-MS—86-99) Processing and disposal of defense nuclear waste at the Savannah River Plant.** Wilhite, E.L.; Ebra, M.A.; Stone, J.A.; Stevens, W.R. III. (Savannah River Lab., Aiken, SC (USA)). 1987. Contract AC09-76SR00001. 11p. (CONF-870435—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014304/JAW.

From Energy '87: energy solutions today for the nineties; Atlantic City, NJ, USA (27 Apr 1987).

High-level nuclear wastes have been stored in large underground tanks at the Savannah River Plant. Processing of the wastes for ultimate disposal will begin in 1988. Nuclear wastes will be processed to separate the high-level radioactive fraction from the low-level fraction. The separation will be made in existing waste tanks by a process combining precipitation, adsorption, and filtration. The high-level fraction will be vitrified into borosilicate glass in the Defense Waste Processing Facility (DWPF) for disposal in a federal repository. The low-level fraction (decontaminated salt solution) will be mixed with a cement-fly ash blend. The resulting product, "saltstone," will be disposed of onsite by emplacement in an

engineered facility. Waste properties, disposal facility details, and wasteform characteristics will be presented. Results of a field test of contaminant release from saltstone and modeling studies to predict releases will also be described. 14 refs., 2 figs., 4 tabs.

48252 **(DP-MS—86-126) Startup sequence of the DWPF [Defense Waste Processing Facility] scale glass melter.** Weisman, A.F. (Savannah River Lab., Aiken, SC (USA)). 1986. Contract AC09-76SR00001. 10p. (CONF-860905—36). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014307/JAW.

From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, NY, USA (14 Sep 1986).

The Du Pont Company is building a facility at the Savannah River Plant to immobilize high level radioactive waste within a borosilicate glass matrix. The process, known as the Defense Waste Processing Facility (DWPF), is scheduled to begin operation in 1989. The design and operation of the DWPF Glass Melter will be demonstrated during testing of a 2/3 linear scale melter. This paper reviews the startup phase of the Scale Glass Melter, completed in February 1986, which is representative of the planned DWPF melter startup. 3 refs., 3 figs.

48253 **(DP-MS—86-162) Toward acceptance of DWPF glass at a Federal Repository.** Plodinec, M.J.; Stevens, W.R. III; Hacker, B.A.; Baxter, R.G. (Savannah River Lab., Aiken, SC (USA)). 1987. Contract AC09-76SR00001. 13p. (CONF-870306—75). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014514/JAW.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

Construction of the nations's first facility to immobilize defense high-level nuclear waste, the Defense Waste Processing Facility (DWPF) at the Savannah River Plant, is scheduled to be completed soon. The Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM) has set up a Waste Acceptance Process to provide reasonable assurance that the waste glass produced in the DWPF will be acceptable for permanent storage in a federal repository. As part of this process, detailed specifications have been developed for the waste glass itself, the canister which will contain the waste glass, the sealed canister after it is filled with waste glass, and quality assurance of the product. Savannah River has developed a detailed strategy for demonstrating compliance with each of the specifications, which is documented in a Waste Compliance Plan (WCP). In this paper, the compliance strategy, and progress in implementing the WCP are presented. 12 refs., 3 figs.

48254 **(DP-MS—87-159) Behavior and removal of organic species in the Savannah River Plant Effluent Treatment Facility.** Oblath, S.B.; Georgeton, G.K. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 5p. (CONF-880903—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010614/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

The Effluent Treatment Facility (ETF) at the Savannah River Plant (SRP) is a new facility designed to treat and decontaminate low-level radioactive wastewater prior to release to the environment. The waste water is primarily composed of evaporator overheads from the chemical separations and waste handling facilities at SRP. Primarily a 2000 mg/L $NaNO_3$ solution, the wastewater also contains microcuries- per-liter quantities of radionuclides and milligram-per-liter concentrations of heavy metals and organic components. Both the composition of the wastewater to be treated and a physical description of the facility have been given. 6 refs., 2 figs.

48255 **(DP-MS—87-174) A product consistency durability test for SRP nuclear waste glass.** Bibler, N.E.; Jantzen, C.M. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 31p. (CONF-880504—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013953/JAW.

From 90. annual meeting of American Ceramic Society; Cincinnati, OH, USA (1 May 1988).

Beginning in 1990, Savannah River Plant (SRP) will be converting its high-level nuclear waste to a borosilicate glass. To ensure that this glass will be acceptable for permanent storage in a federal repository, SRP must demonstrate that the durability of the glass has been controlled during production. This paper describes the product consistency test (PCT) being developed to demonstrate this control. The PCT measures 7-day releases from crushed glass in deionized water at 90{degree}C. The sensitivity of the PCT to glass composition and homogeneity was determined. Normalized release rates adhered to the linear relationship predicted by the hydration model for glass durability.

48256 **(DP-MS—88-3) Test program for closure activities at a mixed waste disposal site at the Savannah River Plant.** Cook, J.R.; Katz, M.A.; Stevens, C.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 3p. (CONF-880903—13). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number TI88011206/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

A 56-acre site at the Savannah River Plant was used as a low-level radioactive waste disposal facility from 1972 through 1985; however, quantities of the hazardous materials lead, cadmium, scintillation fluid, and oil were disposed of at the site as well. In 1985, operations at the site were halted and a Closure Plan was submitted to the State of South Carolina Department of Health and Environmental Control. The actions leading to closure of the facility will include stabilization, capping, and monitoring. A test program has been conducted to evaluate the feasibility and effectiveness of several stabilization techniques and capping materials.

48257 **(DP-MS—88-4) Hazardous waste reduction at the Savannah River Plant.** McIntyre, P.F.; Orebaugh, E.G.; Sturm, H.F. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1988. Contract AC04-76DP00789. 3p. (CONF-880903—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011241/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

As part of an overall site program, the Savannah River Laboratory (SRL) is actively pursuing methods to reduce volumes of hazardous waste. A major part of this program is directed at identifying non-hazardous materials which can be substituted for hazardous ones. Examples of successful hazardous waste reduction are discussed including the source, the regulatory standards, and the site impact of eliminating or reducing the waste. The current inventory of hazardous waste at the Savannah River Plant (SRP) is approximately 2000 55-gallon drums. The annual generation rate is about 500 drums and the cost for storing is {approximately}$1000.00 per drum. 3 refs.

48258 **(DP-MS—88-35) Removal of TBP [tri-n-butylphosphate] from low-level radioactive wastewater at the Savannah River Plant using non-functionalized resins.** Bibler, J.P. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 10p. (CONF-880903—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010897/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

An effluent treatment facility (F/H ETF) will begin operation at the Savannah River Plant (SRP) beginning November, 1988. The facility will treat low-level radioactive wastewater, primarily evaporator overheads. Currently this waste stream is diverted to seepage basins, however, once the F/H ETF is on line, it will be treated and discharged to an NPDES outfall. Treatment consists basically of microfiltration following pH adjustment, reverse osmosis (RO), and final polishing by cation exchange. Activated carbon columns were recently added to the treatment process between the filtration and RO steps to remove organic species, primarily tri-n-butylphosphate (TBP) and n-paraffinic hydrocarbons (NPH). This was done to ensure that discharge limits for oil and grease and biochemical oxygen demand (BOD) will not be exceeded and to protect the RO membranes, which experience an unacceptably rapid

loss of flux due to fouling when treating waste streams containing these organics. The carbon columns will not be regenerated and the large volume of secondary waste associated with their disposal has led to investigations of alternative methods for organic removal that will minimize waste generation. 3 refs., 3 figs., 2 tabs.

48259 **(DP-MS—88-51) Optimum DWPF [Defense Waste Processing Plant] processing rate.** Goodlett, C.B.; McDonnell, W.R.; Thomas, S.D.; Geiger, J.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 3p. (CONF-880903—12). NTIS, PC A02. Order Number DE88010613/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

The optimum rate for processing radioactive waste through the Defense Waste Processing Plant (DWPF) Vitrification Plant has been developed consistent with operating and economic constraints imposed by feed preparation requirements. Results indicate there is little difference between operating at the maximum versus the minimum rate. The maximum processing rate is constrained by the radioactivity of the sludge component of the waste, while the minimum rate is established by the residence time of a radioactive organic precipitate produced during removal of Cs-137 from the waste salt in the storage tanks. Considerations impacting the rate of DWPF processing include safety of storing radioactive liquids versus a solid waste form; liquid storage space available in the existing waste tanks; time required to allow for radioactive decay of the heat generating wastes; and relative costs of DWPF operation versus interim storage capacity for the waste glass canisters. 10 refs., 2 figs.

48260 **(DPST—86-378) A method of determining weight percent solids in SRAT/SME slurries as a function of temperature.** Sturcken, E.F. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 6 May 1986. Contract AC09-76SR00001. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014794/JAW.

A combination microwave oven-electric furnace method was developed for use in the DWPF that determines calcined wt.% solids in SRAT and SME slurries in 1.25 hrs vs 6 hrs by conventional methods. The optimum calcining temperature was determined to be 600{degree}C to 650{degree}C. The detailed procedure for determining calcined wt.% solids is given in the Appendix. The largest changes in wt.% solids due to calcining are caused by the presence of organic materials such as formic acid.

48261 **(DPST—87-801) SGM [Scale Glass Melter] Run 8; Canister and glass temperatures during filling and cooldown.** Edwards, R.E. (Savannah River Lab., Aiken, SC (USA)). 31 Dec 1987. Contract AC09-76SR00001. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013779/JAW.

Canister surface temperatures and interior canister glass temperatures were measured during filling and cooldown for three canisters filled under reference DWPF pour conditions during SGM Run 8. Pertinent results for these three canisters are presented along with the results for canister MS-21 which was produced under DWPF conditions in March 1983 using the LSFM melter. Important findings from the measurements of this study are included. The maximum canister surface temperature ranged between 470 and 500 C for continuously filled canisters, and as high as 552 C for a batch filled canister. The time required for the maximum surface temperature to decrease to less than 100 C (required before a canister can be decontaminated) ranged from 33 to 36 hours after the pour was stopped. The time required for the maximum glass centerline temperature to decrease to less than 500 C ranged from 16 to 17 hours after the pour was stopped for both continuously and batch filled canisters. As noted in prior canister temperature measurements, the canister behaves like an infinite cylinder in terms of heat loss over the canister elevation range of 15 to 75 inches. As the glass leaves the melter pour spout and travels through the canister, it cools approximately 30 C per foot. The decrease in glass temperature as it travels through the canister is not perfectly linear, but this assumption yields the 30 C per foot value. 8 refs., 4 figs., 1 tab.

48262 **(EGG-HWP—8037) Idaho National Engineering Laboratory hazardous and radioactive mixed waste identification and characterization report for CY 1987.** Nishimoto, D.D. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1988. Contract AC07-76ID01570. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015097/JAW.

The purpose of this report is to review and update the listing of hazardous waste (HW) and radioactive mixed waste (RMW) generated at the Idaho National Engineering Laboratory (INEL), both currently and in the future, that are managed at some point by EG and G Environmental Programs (EP). HW and RMW streams are identified and characterized for the past year (CY 1987) and projected for the next ten years. Wastes covered in this report include HW as defined by the Resource Conservation and Recovery Act, toxic wastes as defined by the Toxic Substances Control Act, e.g., polychlorinated biphenyl (PCB) wastes, and other wastes that require special handling. For the purposes of this report, RMW is defined as low-level radioactive waste [i.e., radioactive waste not classified or managed as high-level waste, transuranic (TRU) waste, spent nuclear fuel, or by-product material] that also qualifies as HW per RCRA 40 CFR 261 regulations. The report is organized as follows: Section 2 provides a brief description of the INEL facilities and operating contractors; the lists of HW and RMW handled during CY 1987 are given in Section 3; Section 4 includes the updated waste generation projections for the next ten years for all INEL facilities. 6 refs., 1 fig., 7 tabs.

48263 **(EGG-M—30987) Results of field testing of waste forms using lysimeters.** McConnell, J.W., Jr.; Rogers, R.D. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 4p. (CONF-880354—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015129/JAW.

From Waste management '88; Tucson, AZ, USA (1 Mar 1988).

The purpose of the field testing task, using lysimeter arrays, is to expose samples of solidified resin waste to the actual physical, chemical, and microbiological conditions of disposal enviroment. Wastes used in the experiment include a mixture of synthetic organic ion exchange resins and a mixture of organic exchange resins and an inorganic zeolite. Solidification agents used to produce the 4.8-by 7.6-cm cylindrical waste forms used in the study were Portland Type I-II cement and Dow vinyl ester-styrene. Seven of these waste forms were stacked end-to-end and inserted into each lysimeter to provide a 1-L volume. There are 10 lysimeters, 5 at ORNL and 5 at ANL-E. Lysimeters used in this study were designed to be self-contained units which will be disposed at the termination of the 20-year study. Each is a 0.91-by 3.12-m right-circular cylinder divided into an upper compartment, which contains fill material, waste forms, and instrumentation, and an empty lower compartment, which collects leachate. Four lysimeters at each site are filled with soil, while a fifth (used as a control) is filled with inert silica oxide sand. Instrumentation within each lysimeter includes porous cup soil-water samplers and soil moisture/temperature probes. The probes are connected to an on-site data acquisition and storage system (DAS) which also collects data from a field meteorological station located at each site. 9 refs.

48264 **(EGG-M—36687) Performance history of the WERF [Waste Experimental Reduction Facility] incinerator.** Dalton, J.D.; Bohrer, H.A.; Smolik, G.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 14p. (CONF-880526—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015100/JAW.

From International conference on incineration of hazardous and radioactive waste; San Francisco, CA, USA (3 May 1988).

As society's environmental conscience grows, diverse political, economical, and social contentions cloud the issue of proper waste management. However, experience at the Waste Experimental Reduction Facility (WERF) at the Idaho National Engineering Laboratory (INEL) demonstrates clearly that incineration is an effective component in responsible, long-term waste management. Using a simple but safe design, the WERF incinerator has successfully reduced the volume of low-level beta/gamma waste. As of the end of March, 1988, this incinerator, a 180-kg/h (400-lb/h) controlled-air unit with a completely dry off-gas treatment system, has accumulated approximately 4500 hours of operation, processing

over 4250 M^3 (150,000 ft^3) of waste, and achieving volume reduction ratios of approximately 300:1. This paper discusses some of the achievements and problems experienced during operation of the WERF incinerator. 1 ref., 4 figs., 4 tabs.

48265 **(EGG-M—38587) Testing of the PREPP [Process Experimental Pilot Plant] rotary kiln for waste incineration.** McFee, J.N.; Gale, L.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 11p. (CONF-880526—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015098/JAW.

From International conference on incineration of hazardous and radioactive waste; San Francisco, CA, USA (3 May 1988).

The Process Experimental Pilot Plant (PREPP) rotary kiln incinerator was constructed at the Idaho National Engineering Laboratory (INEL) to process transuranically contaminated waste stored at the INEL. To meet Resource Conservation and Recovery Act (RCRA) requirements, instrumentation changes and ventilation system modifications were necessitated required. The impact of the modifications necessary to meet these RCRA regulations are discussed. The incinerator is now undergoing its third thermally hot nonradioactive test series. A first test series identified necessary off-gas system modifications results are presented. During a second test series, data were obtained on the system components which limit waste processing capacity. Accomplished and planned modifications resulting from this information are presented. An RCRA trial burn plan has been developed. The trial burn will use the most-difficult-to-destroy organic compounds in the anticipated PREPP feed stream and the highest expected solid feed rate. 8 figs.

48266 **(EGG-M—88222) Minimizing emergency response waste by supercompaction.** Darnell, G.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 10p. (CONF-8806116—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015135/JAW.

From French bilateral symposium on accident exercises and experiences; Tours, France (20 Jun 1988).

Low-level radioactive waste (LLW) generated during an emergency is rarely suitable for disposal in its original packages. If suitable space is available, and the containers are secure, the waste may be stored until economical treatment and disposal can be accomplished. When space is not available, or the waste is so poorly packaged that treatment and repackaging cannot be delayed, then the emergency continues. Acceptable emergency waste treatment for proper disposal is available in the form of a mobile supercompactor. Emergency treatment and repackaging can rival current routine waste treatment and packaging for excellence and compliance with disposal regulations. The major limitation is the radiation level of the individual waste package; 200 mrem/h is a logical limit. Tests, demonstrations, and operational treatments all show that mobile supercompaction is a viable solution for both treatment and repackaging of most wastes.

48267 **(EGG-WM—8154) Second progress report for the WERF incinerator.** Dalton, J.D. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1988. Contract AC07-76ID01570. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015175/JAW.

The Waste Experimental Reduction Facility (WERF) has been incinerating low-level beta/gamma waste at the Idaho National Engineering Laboratory (INEL) since September 1984. Since initial contaminated waste processing began, over 164,000 ft^3 of waste has been incinerated in roughly 4800 hrs of operation. Overall, this operation has achieved high performance marks. The current volume reduction attained, approximately 300:1, has exceeded expectations. Off-gas treatment effectively controls radionuclide emissions at approximately 2 μCi per year. In addition a site-wide waste segregation program combined with a simple but effective system design has resulted in low system material degradation. Furthermore, as experience has been gained, system operations have been and continue to be optimized, equipment reliability has been increased, and the waste radiation acceptance criterion has been expanded to increase the quantity of waste acceptable for incinerating. Notable accomplishments since the last progress report include a new ash ram made from a more corrosion-resistant alloy, a modified fuel system that includes a safer and larger fuel tank, a new ash handling system capable of crushing large clinkers, and a test of the liquid waste system in a trial burn. 6 refs., 19 figs., 4 tabs.

48268 **(EPRI-NP—5838) Advanced radioactive waste compaction techniques: Final report.** Volodzko, M.; McGrath, R.N.; Kinsman, J.F.; Palo, W.J. (Electric Power Research Inst., Palo Alto, CA (USA); Combustion Engineering, Inc., Windsor, CT (USA)). Aug 1988. 169p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015532/JAW.

The purpose of this test program is to provide definitive information on the volume reduction capabilities of conventional compactors used in the nuclear industry for the treatment of dry active waste and the effects of preshredding on compaction. The test program presents comprehensive data on compacted densities of dry active waste collected at five facilities generating this waste and using conventional compactors. Waste materials presently classified as "non-compactable" which would lend themselves to preshredding and compaction are identified. An ALARA evaluation of shredding operations and an economic evaluation of preshredding prior to compaction are also presented. 32 figs., 72 tabs.

48269 **(EPRI-NP—5957) Radioactive waste volume reduction and solidification systems: Byron fluidized-bed/Dow-polymer system and Fermi-2 asphalt extruder-evaporator.** Elguindy, H.S.; Krohn, F.M.; Nelson, R.A.; Wright, E.L. (Electric Power Research Inst., Palo Alto, CA (USA); Sargent and Lundy, Chicago, IL (USA)). Aug 1988. 123p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015530/JAW.

Two advanced volume reduction and solidification systems (VRSS) have recently been preoperationally tested at US nuclear power plants. One is an integrated Aerojet Energy Conversion Company/Stock Equipment Company system at Commonwealth Edison Company's Byron Station. The other is a WasteChem Corporation system at Detroit Edison Company's Fermi-2 plant. The VRSS at Byron is the first fluidized-bed/Dow polymer system to be installed in a commercial nuclear power plant. It is expected to begin processing radioactive waste in 1987. Sections 2 to 6 of this document present a report on the background, installation, and testing of this volume reduction system. The results of the acceptance/startup tests performed from 1984 to 1986, along with the operating and processing parameters that were selected for these tests, are presented. Descriptions of the process and the system are also included. The VRSS at Fermi-2 is the first asphalt extruder-evaporator selected specifically to process powdered ion-exchange resin. The processing of radioactive waste is expected to begin in 1987. Appendix D of this document is a progress report on the installation of and testing experiences with this volume reduction system. This appendix briefly describes the removal of the original cement solidification system and the installation of the new asphalt system, followed by a review of the startup problems to date and their solutions. 10 refs., 7 figs., 9 tabs.

48270 **(GSF—1/88) Determination of soil mechanics of salt rock as a potential backfilling material in an underground repository.** Kappei, G. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Braunschweig (Germany, F.R.). Inst. fuer Tieflagerung). Sep 1987. 187p. (In German). (GSF-TL—60/87). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754644/JAW.

Within the framework of the research and development project 'Backfilling and sealing of boreholes, chambers and roadways in a final dump', the Institute for Underground Dumping chose - from the broad range of possible stowing materials - the material 'salt spoil' and investigated its soil-mechanical properties in detail. Besides the implementation of soil-mechanical standard analyses (determination of the grain size distribution, bulk density, limits of storage density, proctor density, permeabilities, and shear strength) of two selected salt spoils (heap salt and rock salt spoil), the studies concentrated on the determination of the compression behaviour of salt spoil. In order to obtain data on the compaction behaviour of this material in the case of increasing stress, compression tests with obstructed lateral expansion were carried out on a series of spoil samples differing mainly in the composition of grain

sizes. In addition to this, for a small number of samples of rock salt spoil, the creep behaviour at constant stress was determined after the compaction phase.

48271 **(GSF—29/87) Seismicity and seismic monitoring in the Asse salt mine.** Flach, D.; Gommlich, G.; Hente, B. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Braunschweig (Germany, F.R.). Inst. fuer Tieflagerung). 1987. 142p. (In German). (GSF-TL—50/87). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88754646/JAW.

Seismicity analyses are made in order to assess the safety of candidate sites for ultimate disposal of hazardous wastes. The report in hand reviews the seismicity history of the Asse salt mine and presents recent results of a measuring campaign made in the area. The monitoring network installed at the site supplies data and information on the regional seismicity, on seismic amplitudes under ground and above ground, and on microseismic activities.

48272 (INIS-BR—1147-Vol.2, pp 243-250) **Recovery of transuranium elements in tracer level of solid wastes.** Carvalho, E.I. de; Yamaura, M.; Matsuda, H.T.; Araujo, J.A. de; Araujo, B.F. de. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A procedure for recovery transuranium elements from lab scale solid waste is presented. As a first step acid leaching is used. For the concentration step, valence state adjustment is required in order to get the best condition for the sorption on chromatographic Al/sub 2/O/sub 3/ column in HNO/sub 3/ - HF medium. The process is safe, reliable and useful for environmental and waste treatment applications.

48273 (INIS-BR—1147-Vol.2, pp 251-258) **Sorption of transuranium elements in inorganic exchangers. Parte 1 - Neptunium separation in the Al/sub 2/O/sub 3/ - HNO/sub 3/ - HF-UO/sub 2/(NO/sub 3/)/sub 2/.** Oliveira, C.A.L.G. de; Yamaura, M.; Matsuda, H.T.; Araujo, B.F. de. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The neptunium separation, in tracer level, in the Al/sub 2/O/sub 3/-HNO/sub 3/-HF-UO/sub 2/ (NO/sub 3/)/sub 2/ system has been studied. By the valence variation, it was verified, that neptunium is retained in the alumina column as Np(IV). In the fixed experimental conditions, the uranyl ion is not retained, making possible its separation from neptunium. The neptunium elution was obtained by its reoxidation to Np(V), using the nitrite ion. This procedure is useful for analytical and process R and D, using as a tracer for neptunium the gamma-emitter /sup 239/Np. In the recovery of neptunium from LAW and the third uranium purification cycle of spent fuel treatment this procedure can be also used.

48274 (INIS-BR—1147-Vol.2, pp 269-277) **Retention of nitrous gases in scrubber columns.** Nakazone, A.K.; Costa, R.C.; Lobao, A.S.T.; Matsuda, H.T.; Araujo, B.F. de. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

During the UO/sub 2/ dissolution in nitric acid, some different species of NO (sub)x are released. The off gas can either be refluxed to the dissolver or be released and retained on special colums. The final composition of the solution is the main parameter to take in account. A process for nitrous gases retention using scrubber colums containing H/sub 2/O or diluted HNO/sub 3/ is presented. Chemiluminescence measurement was employed to NO/sub x/ evaluation before and after scrubing. Gas flow, temperature, residence time are the main parameters considered in this paper. For the dissolution of 100g UO/sub 2/ in 8M nitric acid, a 6NL/h O/sub 2/ flow was the best condition for the NO/NO/sub 2/ oxidation with maximum absorption in the scrubber columns.

48275 (INIS-BR—1147-Vol.2, pp 279-287) **Gaseous cleaning in enrichment installations.** Schvartzman, M.M.A.M.; Vasconcelos, M.C.R.L.; Cardoso, S.N.M. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Uranium hexafluoride (UF/sub 6/), either pure or mixed to other gases, is widely used as a process gas in the great majority of the known uranium isotopic enrichment processes. Due to a long term operation of the enrichment facilities there is a decomposition of the UF/sub 6/ to solid products like UO/sub 2/F/sub 2/ and UF/sub 5/ which deposit on the walls of the reservoirs. This work describe s a cleaning process used to remove the solid products of the UF/sub 6/ decomposition from one of the reservoirs (V = 620 l) of the Jet Nozzle enrichment project facilities of the Centro de Desenvolvimento da Tecnologia Nuclear, CDTN/Belo Horizonte. It used a gaseous mixture which presented the advantage of cleaning up the reservoir without dismounting the equipment. The products are all gaseous and can be easily pumped out.

48276 (INIS-BR—1147-Vol.2, pp 299-307) **Recovery of valuable products in liquid effluents from uranium and thorium pilot units.** Jardim, E.A.; Abrao, A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

IPEN-CNEN/SP has been very active in refining yellowcake to pure ammonium diuranate which is converted to uranium trioxide, uranium dioxide, uranium tetra- and hexafluoride in a sequential way. The technology of the thorium purification and its conversion to nuclear grade products has been a practice since several years as well. For both elements the major waste to be worked is the refinate from the solvent extraction column where uranium and thorium are purified via TBP-varsol in pulsed columns. In this paper the actual processing technology is reviewed with special emphasis on the recovery of valuable products, mainly nitric acid and ammonium nitrate. Distilled nitric acid and the final sulfuric acid as residue are recycled. Ammonium nitrate from the precipitation of uranium diuranate is of good quality, being radioactive and uranium-free, and recommended to be applied as fertilizer. In conclusion the main effort is to maximise the recycle and reuse of the above mentioned chemicals.

48277 (INIS-BR—1147-Vol.2, pp 309-315) **Treatment of the effluent generated in conversion process of AUC by precipitation.** Carvalho, E.F.U. de; Santos, L.R. dos; Riella, H.G. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The purpose of this study is to provide a description for the treatment of generating effluent from Ammonium Uranyl Carbonate-AUC IPEN/CNEN-SP. This procedure describes the uranium recovery (200 mlU/1) by means of its precipitation with hydrogen peroxide at 50/sup 0/C, pH 8,5 where results a yellow powder thought to be UO/sub 4/2NH/sub 3/2HF and a NH/sub 4/F solution with an uranium concentration of 6-7mgU/1. The powder resulted was characterized by chemical analysis and X-ray difraction techniques.

48278 (INIS-BR—1147-Vol.2, pp 337-347) **Utilization of the national Portland cement for immobilizing radioactive wastes - Physical characteristics.** Rzyski, B.M.; Suarez, A.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

This paper shows the results obtained in the study of the national Portland cement, P320, as matrix for radioactive nitric waste incorporation. Cement use in other countries is common for this purposes and demonstrates to be cheap and accessible when low and medium level wastes are immobilized. Some physical characteristics such as: homogeneity,mechanical strenghth, setting and porosity are analysed due to water-cement ratio and salt contents. Those characteristics which are proper of the final product, must be controlled in such a way to assure a long time integrity of the waste-form. The establishment of process and quality control criteria are based in such kind of data.

48279 (INIS-BR—1147-Vol.2, pp 289-298) **Qualification of A type package for transport and final disposal of radium-226 needles.** Rodrigues, D.L.; Vicente, R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

One of the objectives of the Fuel Cycle Department is to develop packages for radioactive wastes, including discarded industrial and radiotherapy sources. This paper describes the work undertaken to qualify a package for transport and final disposal of radium needles, and gives a detailed description of the tests carried out to verify shielding integrity and containment system before and after free drop test according to IAEA recomendations for type A, non-especial form packages. Shielding integrity was verified by gamma field scanning over the package surface, using a Geiger-Muller detector and a /sup 60/Co gamma source. Containment system was verified by pressurizing the specimen with helium and by searching for leaks a He-leak detector, with sensitivity of 3 x 10/sup -10/ atm x cm/sup 3//s, air equivalent. The package is described in detail along with the apparatus for the safe handling and packing of the radium needles.

48280 (INIS-BR—1147-Vol.2, pp 317-324) **Storage and uses alternatives of depleted UF/sub 6/.** Marques, S.; Dotto, R.M. (NUCLEBRAS, Resende (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The U-enrichment of the Angra-1 pellets (Brazil) have generated about 792 ton of depleted-U, which is nowadays being stored by URENCO. The possible sending of this compound to Brazil, added to the fact that in the future, NUCLEI (Nuclebras Enriquecimento Isotopico) itself will generate it, reopens the discussion of the destination of this compound. In this context, the necessity, interest and viability aspects of a reconvertion plant of UF/sub 6/ in Brazil are getting important and are, in what follows, briefly discussed.

48281 (KFK—4360) **Status report on the waste management cooperation programme jointly undertaken by KfK/INE-NUCLEBRAS/CDTN.** Teh Whei Miaw, S. (ed.); Krause, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik; NUCLEBRAS, Belo Horizonte (Brazil); Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil)). Apr 1988. 40p. (NUCLEBRAS-CDTN—594). NTIS (US Sales Only), PC A03/MF A01; GPO Dep. Order Number DE88754603/JAW.

The prime objective of the first phase of the programme was to develop processes for the treatment of the wastes arising at CDTN and to qualify waste forms for final disposal. Chemical precipitation and evaporation have been selected as the main processes for the treatment of low-level liquid wastes. Operating conditions for flocculation have been specified in laboratory-scale experiments. The plant has already been operated successfully. The evaporator nears completion. Two pilot plants for cementation have been erected and investigated, one with an in-drum mixer, the other with an in-tank mixer. Laboratory experiments on cementation have provided the basis for solidification of first batches of waste concentrates. Laboratory experiments on bituminization have started recently. A small-scale bitumen extruder will be put into operation soon. There have also been activities on the development, improvement and test of drums, containers and shielding casks for radioactive wastes.

48282 (LA-UR—88-1560) **Use of the CREAMS [Chemicals, Runoff, and Erosion from Agricultural Management Systems] model to represent soil moisture under various trench cover designs for waste burial.** Devaurs, M.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-880903—9). NTIS, PC A02. Order Number DE88010935/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

The objective of this study is to evaluate the application of CREAMS in conjunction with the tabular values for predicting soil water behavior in trench covers at semiarid sites. Two approaches are presented: the first approach uses the parameters for a given texture class; and the second approach bounds system behavior using a combinatin of maximum and minimum suggested parameters for a given texture class. In this case, the predicted water content values are expected to envelop the observed values thus providing the user with upper and lower limits for predictive pruposes. 9 refs., 3 figs.

48283 (LBL—23215) **Verification, validation, and reliability of predictions.** Pigford, T.H.; Chambre, P.L. (Lawrence Berkeley Lab., CA (USA)). Apr 1987. Contract AC04-76DP00789. 16p. (CONF-870450—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013593/JAW.

From Symposium on verification and validation of geosphere performance assessment models; Stockholm, Sweden (7 Apr 1987).

The objective of predicting long-term performance should be to make reliable determinations of whether the prediction falls within the criteria for acceptable performance. Establishing reliable predictions of long-term performance of a waste repository requires emphasis on valid theories to predict performance. The validation process must establish the validity of the theory, the parameters used in applying the theory, the arithmetic of calculations, and the interpretation of results; but validation of such performance predictions is not possible unless there are clear criteria for acceptable performance. Validation programs should emphasize identification of the substantive issues of prediction that need to be resolved. Examples relevant to waste package performance are predicting the life of waste containers and the time distribution of container failures, establishing the criteria for defining container failure, validating theories for time-dependent waste dissolution that depend on details of the repository environment, and determining the extent of congruent dissolution of radionuclides in the UO_2 matrix of spent fuel. Prediction and validation should go hand in hand and should be done and reviewed frequently, as essential tools for the programs to design and develop repositories. 29 refs.

48284 (LBL—25547) **Numerical modeling of multiphase and nonisothermal flow in fractured media.** Pruess, K.; Narasimhan, T.N. (Lawrence Berkeley Lab., CA (USA)). Jul 1988. Contract AC03-76SF00098. 22p. (CONF-880583—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014855/JAW.

From International conference on fluid flow in fractured rocks; Atlanta, GA, USA (15 May 1988).

Approaches for modeling of coupled multiphase fluid and heat flow in fractured media include "explicit" modeling of fractures, which are represented as domains with small spatial scale and large permeability: effective continuum approximations, in which one attempts to model the composite behavior of a fractured

porous medium in terms of a single effective continuum; and "hybrid" models such as double- or multiple-porosity techniques which combine features of the explicit fracture and effective continuum approaches. We present examples of each of these approaches. The explicit fracture approach has been applied to investigate thermohydrologic conditions near high-level nuclear waste packages emplaced in partially saturated fractured tuffs. Besides providing some useful insight into multiphase flow processes this approach substantiates an effective continuum approximation, which leads to a drastic simplification in the modeling of fractured flow systems. A consideration of diffusive processes in rock matrix and fractures provides criteria for the validity of the effective continuum approximation; these have been verified by means of numerical experiments. Flow studies using the method of "multiple interacting continua" have demonstrated how effects of global flow tend to diminish sensitivity to individual matrix block response in enhanced oil recovery and in heat mining in geothermal systems. In some cases simple semi-analytical techniques are found to provide an adequate approximation to the complexities of multiple-continua behavior. 25 refs., 4 figs., 4 tabs.

48285 **(LBL—25594) Mass transfer and transport of radionuclides in fractured porous rock.** Ahn, Joonhong. (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract AC03-76SF00098. 172p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88014665/JAW.

Analytical studies are made to predict space-time dependent concentrations of radionuclides transported through water-saturated fractured porous rock. A basic model, which is expected to generate conservative results when used in long-term safety assessment of geologic repositories for radioactive waste, is established. Applicability and limitations of the model are investigated. 67 refs., 54 figs., 3 tabs.

48286 **(NUREG—1307) Report on waste burial charges: Escalation of decommissioning waste disposal costs at low-level waste burial facilities.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering). Jul 1988. 33p. NTIS, PC A03 - GPO. Order Number TI88015466/JAW.

One of the requirements placed upon nuclear power reactor licensees by the US Nuclear Regulatory Commission (NRC) is for the licensees to periodically adjust the estimate of the cost of decommissioning their plant, in dollars of the current year, as part of the process to provide reasonable assurance that adequate funds for decommissioning will be available when needed. This report, which is scheduled to be revised annually, contains the development of a formula for escalating decommissioning cost estimates that is acceptable to the NRC, and contains values for the escalation of radioactive waste burial costs, by site and by year. The licensees may use the formula, the coefficients, and the burial escalation factors from this report in their escalation analysis, or may use an escalation rate at least equal to the escalation approach presented herein. 4 refs., 2 tabs.

48287 **(NUREG/CR—4708-Vol.2) Progress in evaluation of radionuclide geochemical information developed by DOE high-level nuclear waste repository site projects: Report for April 1986--September 1987.** Meyer, R.E.; Arnold, W.D.; Blencoe, J.G.; O'Kelley, G.D.; Land, J.F. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Waste Management; Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 65p. (ORNL/TM—10147-Vol.2). NTIS, PC A04/MF A01 - GPO. Order Number TI88015467/JAW.

During this report period, all experiments were conducted with tuff from the proposed high-level nuclear waste site at Yucca Mountain, Nevada. Batch sorption ratio determinations were conducted for strontium, cesium, uranium, and technetium onto samples of tuff using real and synthetic groundwater J-13. There were no significant differences in sorption ratios in experiments with real and synthetic groundwater. Columns were tested by determination of elution curves in J-13 containing tritium and technetium as the TcO_4/sup {minus}/ ion. For strontium and cesium, fairly good correlation between values of the sorption ratio obtained by the two methods was observed. Little technetium sorption was observed with either method. The elution peaks obtained with neptunium and uranium were asymmetrical and the shapes were often complex, observations which suggest irreversibilities in the sorption reaction. Synthetic groundwater J-13 was slowly dripped onto a slab of tuff maintained at 95--100{degree}C, and the result was a thin encrustation of solids on the slab as the water evaporated. Fresh J-13 groundwater was then allowed to contact the encrustation in a vessel maintained at 90{degree}C. The principal result of the experiment was a significant loss of calcium and magnesium from the fresh J-13 groundwater. 13 refs. 25 figs., 9 tabs.

48288 **(NUREG/CR—4735-Vol.4) Evaluation and compilation of DOE waste package test data: Biannual report, August 1987--January 1988.** Interrante, C.; Escalante, E.; Fraker, A.; Ondik, H.; Plante, E.; Ricker, R.; Ruspi, J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards; National Bureau of Standards, Washington, DC (USA)). Aug 1988. 181p. NTIS, PC A09/MF A01 - GPO. Order Number TI88015610/JAW.

This report summarizes results of the National Bureau of Standards (NBS) evaluations on waste packages designed for containment of radioactive high-level nuclear waste (HLW). The waste package is a proposed engineered barrier that is part of a permanent repository for HLW. Metal alloys are the principal barriers within the engineered system. Since enactment of the Budget Reconciliation Act for Fiscal Year 1988, the Yucca Mountain, Nevada, site (in which tuff is the geologic medium) is the only site that will be characterized for use as high-level nuclear waste repository. During the reporting period of August 1987 to January 1988, five reviews were completed for tuff, and these were grouped into the categories: ferrous alloys, copper, groundwater chemistry, and glass. Two issues are identified for the Yucca Mountain site: the approach used to calculate corrosion rates for ferrous alloys, and crevice corrosion was observed in a copper-nickel alloy. Plutonium can form pseudo-colloids that may facilitate transport. NBS work related to the vitrification of HLW borosilicate glass at the West Valley Demonstration Project (WVDP) and the Defense Waste Processing Facility (DWPF) and activities of the DOE Materials Characterization Center (MCC) for the 6-month reporting period are also included. 27 refs., 3 figs.

48289 **(NUREG/CR—5054) Recommendations to the NRC for review criteria for alternative methods of low-level radioactive waste disposal: Environmental monitoring and surveillance programs.** Denham, D.H.; Stenner, R.D.; Eddy, P.A.; Jaquish, R.E.; Ramsdell, J.V. Jr. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Low-Level Waste Management and Decommissioning; Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 194p. (PNL—6553). NTIS, PC A09/MF A01 - GPO. Order Number TI88014681/JAW.

Licensing of a facility for low-level radioactive waste disposal requires the review of the environmental monitoring and surveillance programs. A set of review criteria is recommended for the US Nuclear Regulatory Commission (NRC) staff to use in each monitoring phase—preoperational, operational, and post operational—for evaluating radiological and selected nonradiological parameters in proposed environmental monitoring and surveillance programs at low-level waste disposal facilities. Applicable regulations, industry standards, and technical guidance on low-level radioactive waste are noted throughout the document. In the preoperational phase, the applicant must demonstrate that the environmental monitoring program identifies radiation levels and radionuclide concentrations at the site and also provides adequate basic data on the disposal site. Data recording and statistical analyses for this phase are addressed.

48290 **(ORNL/TM—9322) Review of EPA, DOE, and NRC regulations on establishing solid waste performance criteria.** Mattus, A.J.; Gilliam, T.M.; Dole, L.R. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015331/JAW.

This report provides a comprehensive review of the regulations concerning hazardous and radioactive waste disposal that have been issued by the US Department of Energy, the US Environmental Protection Agency, and the US Nuclear Regulatory Commission. This document addresses regulations pertaining to performance and testing requirements for solid waste forms. In cases where performance and testing requirements are tied to classification of waste forms or setting of minimum standards for groundwater, these latter topics were also reviewed. This report summarizes and compares the various regulations regarding waste disposal, and to present those regulations in an easily understandable fashion. The primary uses of this document should be to become familiar with the regulations and to compare the requirements of the various agencies. Because this is a summary document, references are made to the original regulatory documents when decisions concerning testing or waste disposal are affected by the regulations concerned herein. Also new regulations and updates are continuously being issued and should be reviewed frequently to stay abreast of possible regulatory changes. 19 refs., 1 fig. 5 tabs.

48291 **(ORNL/TM—10856) Diffusion of waste technologies and its potential impact on research and development.** Rivera, A.L. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015380/JAW.

The concept of waste technilogy diffusion as a driving force in research an development (R & D) planning is discussed. Technology diffusion is presented as a mechanism that supports the definition of R & D needs and priorities. The greatest barriers to continuing innovation are waste technology diffusion and uncertainty over performance. Consequently, there is no substitute for real-life demonstrations in high-leveraged applications. This technology demonstration phase is critical in the formulation of the issues, questions, and priorities to be addressed by technology R & D activities. 8 refs., 4 figs., 5 tabs.

48292 **(PB—88-216106/XAB) Low-level and NARM radioactive wastes. Model documentation PRESTO-EPA-POP. Volume 1. Methodology manual. Final report.** Fields, D.E.; Little, C.A.; Parraga, F.; Rogers, V.; Hung, C. (Office of Radiation Programs, Washington, DC (USA)). Dec 1987. 188p. (EPA—520/1-87/024/1). NTIS, PC A09/MF A01.

See also Volume 2, PB—88-216114 and PB—88-197280.

This is a two-volume documentation that provides the background information on the mathematical modeling used to generate the basic data for the Environmental Impact Statement (EIS) which is used to support EPA's rulemaking for generally applicable environmental standards for the management and disposal of low-level radioactive wastes (LLW). Volume 1 presents the theoretical bases of the mathematical model and their implemented computer code for the assessment of the cumulative population health effects to the general population residing in the downstream regional basin of a LLW disposal site.

48293 **(PB—88-216114/XAB) Low-level and NARM radioactive wastes. Model documentation PRESTO-EPA-POP. Volume 2. Users manual. Final report.** Fields, D.E.; Little, C.A.; Parraga, F.; Rogers, V.; Hung, C. (Office of Radiation Programs, Washington, DC (USA)). Dec 1987. 260p. (EPA—520/1-024/2). NTIS, PC A12/MF A01.

See also Volume 1, PB—88-216106.

This is a two-volume documentation that provides the background information on the mathematical modeling used to generate the basic data for the Environmental Impact State (EIS) which is used to support EPA's rulemaking for generally applicable environmental standards for the management and disposal of low-level radioactive wastes (LLW). Volume 2 provides the information on the structure of the computer code and how it is used in the health-effects assessments. The two volumes present enough detail so that interested persons may apply the model, using appropriate and applicable input data, for assessing the cumulative population health effects from a LLW disposal site.

48294 **(PNL—6585) An evaluation of the effects of well construction materials and ground-water sampling equipment on concentrations of volatile organic compounds.** Liikala, T.L.; Daly, D.S.; Toste, A.P. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014685/JAW.

In 1985, the Pacific Northwest Laboratory conducted a study on ground-water samples collected from the 300 Area of the Hanford Site, which is located in southeastern Washington. The purpose of the study was to evaluate how well construction materials and ground-water sampling equipment affect measured concentrations of volatile organic compounds on the ground water. Ground-water samples were collected in an area of known contamination from two monitoring wells. Sampling was conducted for a total of 4 weeks using three dedicated sampling devices. Each sample was analyzed for volatile organic content by gas chromatography with electron capture detection. The data were statistically analyzed to ascertain differences in concentrations of contaminants resulting from well construction materials and ground-water sampling equipment. No statistically significant differences in concentrations of volatile organic compounds were found resulting from the well construction materials and ground-water sampling equipment. Analyses indicate a correlation between constituent concentration and sample date and, to a lesser degree, water table elevation. The range in concentrations during the study was greater than the differences caused by the two wells and three sampling devices. 4 refs., 10 figs., 5 tabs.

48295 **(PNL-SA—15713) Comparison of source-term calculations using the AREST and SYVAC-Vault models: [Final report].** Apted, M.J.; Engel, D.W.; Garisto, N.C.; LeNeveu, D.M. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 18p. (CONF-880601—42). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014084/JAW.

From American Nuclear Society annual meeting; San Diego, CA, USA (12 Jun 1988).

A comparison of the calculated radionuclide release from a waste package in a geologic repository has been performed using the verified SYVAC-Vault Model and AREST Model. the purpose of this comparison is to further establish the credibility of these codes for predictive performance assessment and to identify improvements that may be required. A reference case for a Canadian conceptual design with spent fuel as the waste form was chosen to make an initial comparison. The results from the two models were in good agreement, including peak release rates, time to reach peak release, and long term release rates. Differences in results from the two models are attributed to differences in computational approaches. Studies of the effects of sorption, convective flow, distributed containment failure, and precipitation are identified as key areas for further comparisons and are currently in progress. 11 refs., 3 figs., 5 tabs.

48296 **(PNL-SA—15767) In Situ Vitrification: Recent test results for a contaminated soil melting process.** Buelt, J.L.; Timmerman, C.L.; Westsik, J.H. Jr. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 33p. (CONF-8806186—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014081/JAW.

From American Chemical Society Northwest Regional meeting; Spokane, WA, USA (30 Jun 1988).

In Situ Vitrification (ISV) is being developed at Pacific Northwest Laboratory for the Department of Energy and other clients for the stabilization of soils and sludges contaminated with radioactive and hazardous chemical wastes. ISV is a process that immobilizes contaminated soil in place by converting it to a durable glass and crystalline product that is similar to obsidian. In June 1987, a large-scale test of the process was completed at a transuranic- contaminated soil site. This constituted the first full-scale demonstration of the ISV process at an actual site. This paper summarizes the preliminary results of this test and describes the processes' potential adaptation to radioactive and hazardous chemical waste contaminated soils. 10 refs., 10 figs.

48297 **(PTB-SE—20) Requirements on waste forms for the planned Konrad repository based on criticality calculations.** Berg, H.P. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle). Feb 1988. 20p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754677/JAW.

In the framework of the safety analyses for the planned Konrad repository it has been investigated whether a criticality incident may be possible during the operational phase or in the post-operational phase. The analysis has shown that the criticality safety is ensured by limitation of a mass concentration of the fissile material in the waste form group and by determination of a maximum permissible mass of fissile material per waste package. The resulting requirements of the waste packages, including a mixture in the cross-section of an emplacement room, are explained.

48298 **(SAND—87-1133C) Development of a methodology of geochemical sensitivity analysis for performance assessment.** Siegel, M.D.; Phillips, S.L.; Leckie, J.O.; Kelly, W.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789;AC03-76SF00098. 39p. (CONF-880973—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number TI88011544/JAW.

From DOE/AECL '87: geostatistical methods for transport modeling; San Francisco, CA, USA (15 Sep 1988).

The objective is the formulation of criteria for valid simplification of radionuclide transport models used in performance assessment. We illustrate the complementary roles played by simple transport models designed to bound the radionuclide discharge over wide ranges of physicochemical conditions, detailed geochemical models that provide a structured method to obtain reliable information about solute/rock/water interactions, and sensitivity and uncertainty analysis techniques used to assess the significance of errors in both data and models. 36 refs., 15 figs.

48299 **(SAND—87-1915C) Seismic design of the waste-handling building at the prospective Yucca Mountain nuclear waste repository.** Subramanian, C.V.; Wu, C.L.; DeGabriele, C.D. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-880903—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011092/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

The site for the first prospective high-level nuclear waste repository is located in Yucca Mountain at the southwest corner of the Nevada Test Site in Nye County, Nevada. The preliminary site investigation and seismic hazard evaluation indicate that the design ground acceleration in the horizontal direction of 0.40 g (with a vertical acceleration equal to two-thirds the horizontal) has a recurrence interval of 2000 years. The site evaluation also indicates a potential for some fault displacement on the geologic faults near the site. Proposed facilities at the prospective repository includes a waste handling building (WHB), the primary facility used for handling radioactive waste materials. This paper summarizes the structural behavior of the WHB resulting from the seismic loads. This summary includes a preliminary seismic evaluation of the WHB, and includes estimates of the seismic design margin, building performance, and the amount of fault displacement that the WHB can accommodate without structural yield failure. 9 refs.

48300 **(WHC-EP—0052) Preliminary evaluation of Hanford liquid discharges to ground.** Jungfleisch, F. (Westinghouse Hanford Co., Richland, WA (USA)). Feb 1988. Contract AC06-87RL10930. 169p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88014016/JAW.

The unpermitted, nonsanitary, liquid waste streams that are discharged to the soil at the Hanford Site are being sampled, analyzed, and evaluated according to the Dangerous Regulations of the State of Washington. For evaluation purposes, the 38 waste streams have been redefined as 52 unique discharges to allow for alternative process configurations of some generating facilities. This preliminary report includes the evaluations of the first 25 discharges that were completely sampled by September 30, 1987. Future reports will include the evaluations of additional discharges as data become available. None of the 25 evaluated discharges are associated with dangerous waste sources. None of these 25 evaluated discharges are either a dangerous waste or an extremely hazardous waste under either the dangerous waste mixtures section or the dangerous criteria section. The largest observed equivalent concentration, which used to evaluate chemical toxicity, is 10 times smaller than the regulatory maximum limit for dangerous waste. The largest observed halogenated hydrocarbon concentration, which is used to evaluate chemical persistence, is 700 times smaller than the regulatory maximum limit for dangerous waste. 11 refs., 2 figs., 14 tabs.

48301 **(WHC-EP—0072) Performance assessment technology development for cleanup and disposal of Hanford defense wastes.** Davis, J.D. (Westinghouse Hanford Co., Richland, WA (USA)). Apr 1988. Contract AC06-87RL10930. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88014617/JAW.

This report constitutes the strategy for identifying, adapting, improving, and using the technology needed to evaluate the long-term environmental consequences of actions proposed for remediation and disposal of radioactive and associated chemical wastes generated by defense-related activities at the US Department of Energy's Hanford Site in Washington State. The objective of the strategy is to advance the technology sufficiently to do the analyses identified by the final environmental impact statement for disposal of Hanford Site defense wastes. 14 refs., 6 figs., 1 tab.

48302 **(WHC-EP—0083) Analysis of the Three Mile Island (TMI) Submerged Demineralizer System (SDS) vessel burial data.** Henrie, J.O.; Murry, G.D. (Westinghouse Hanford Co., Richland, WA (USA)). Nov 1987. Contract AC06-87RL10930. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014619/JAW.

Long-term monitoring if a Submerged Demineralizer System (SDS) vessel buried in its concrete overpack was undertaken at the Hanford Site to determine actual burial conditions during a proposed long-term test period. Parameters of interest were moisture, fission product particulates, pressure, and temperature. An evaluation of the data obtained to date from the SDS vessel shows no abnormalities. Further monitoring of each parameter is expected to continue for at least the next 4 yr. 3 refs., 3 figs., 3 tabs.

48303 **(WHC-EP—0118) Consideration of disposal alternatives for tritium-contaminated wastewater streams at Hanford.** Waters, E.D. (Westinghouse Hanford Co., Richland, WA (USA)). Mar 1988. Contract AC06-87RL10930. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88014648/JAW.

Small quantities of tritium are produced as an undesirable by-product of the operation of light-water reactors. At the US Department of Energy Hanford Site in Washington State, some tritium has been discharged to the environment in low-level liquid and gaseous wastes from the N Reactor plant, but more than 97% of the tritium stays typically within the irradiated fuel as it is delivered for reprocessing. During fuel reprocessing, the tritium is distributed in the process streams, and most of the tritium is presently released to the soil column with excess process condensates from the Plutonium-Uranium Extraction (PUREX) Plant. On an annual basis, approximately 1 g of tritium is discharged in more than 1×10^6 L of process condensate water. Principal tritium release points and quantities are presented in section 4.0. The present study is intended to identify and evaluate alternate methods of tritium control and disposal that might merit additional study or development for potential application to Hanford Site effluents. 30 refs., 15 figs., 5 tabs.

48304 **(WHC-EP—0182-1) Tank farm surveillance and waste status summary report for April 1988.** Thurman, J.M. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015601/JAW.

This report is Westinghouse Hanford Company's official inventory for high-level radioactive waste stored in underground tanks at the Hanford Site. Data that depict the status of stored high-level waste and tank vessel integrity are contained within the

report. The intent of the report is to provide data on each of the existing 177 underground waste tanks, as well as to provide supplemental information regarding tank equipment, tank anomalies, and ongoing investigations.

48305 **(WHC-SA—0067) Presentation to the Portland Executives Association.** Harvey, G.L. (Westinghouse Hanford Co., Richland, WA (USA)). Aug 1987. Contract AC06-87RL10930. 12p. (CONF-8708267—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014615/JAW.

From Portland Executives Association meeting; Portland, OR, USA (20 Aug 1987).

This document contains a transcript of a presentation given to Portland, Oregon citizens. The speaker, an employee of the Westinghouse Hanford Company, describes the Radioactive Waste Mangement Program on the Hanford Reservation, and briefly discusses the technologies available for several types of radioactive wastes. (TEM)

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 48190, 48200, 48201, 48202, 48203, 48204, 48205, 48206, 48207, 48208, 48209, 48210, 48211, 48212, 48213, 48214, 48215, 48216, 48217, 48218, 48219, 48220, 48221, 48222, 48223, 48225, 48226, 48227, 48228, 48229, 48230, 48231, 48233, 48234, 48235, 48236, 48237, 48238, 48240, 48241, 48242, 48243, 48244, 48245, 48246, 48247, 48248, 48249, 48250, 48252, 48253, 48254, 48256, 48257, 48258, 48259, 48261, 48262, 48263, 48264, 48265, 48266, 48267, 48268, 48269, 48282, 48283, 48284, 48286, 48287, 48290, 48291, 48294, 48295, 48298, 48299, 48301, 48303, 48304, 48305, 49565, 49607, 49613, 49700

48306 **(RAE—31-1) Engineering guides for estimating cover material thickness and volume for uranium mill tailings.** Rogers, V.C.; Nielson, K.K.; Merrell, G.B. (Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)). Sep 1982. Contract AC04-76DP00789. 35p. NTIS, PC A03. Order Number DE88013254/JAW.

Five nomographs have been prepared that facilitate the estimation of cover thickness and cover material volume for the Uranium Mill Tailing Remedial Action Program. Key parameters determined include the cover thickness with either a surface radon flux or a boundary radon air concentration criterion and the total volume of cover material required for two different treatments of the edge slopes. Also included in the engineering guide are descriptions and representative values for the radon source term, the diffusion coefficients and the key meteorological parameters. 16 refs., 7 figs., 2 tabs.

48307 **(WHC-EP—0104) PUREX [Plutonium Uranium Extraction] and UO_3 Plant nitrogen oxide monitoring plan.** Pavlina, R.S.; Rasmussen, J.H. (Westinghouse Hanford Co., Richland, WA (USA)). Dec 1987. Contract AC06-87RL10930. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014647/JAW.

The emission of nitrogen oxides (NO/sub x/) from PUREX and UO_3 Plants is subject to limitations set by the US Environmental Protection Agency, Region X (EPA). The Prevention of Significant Deterioration permit number PSD--X80--14, issued by the EPA for PUREX and UO_3 Plants, describes these limits. This document outlines Westinghouse Hanford Company's plan for monitoring the PUREX and UO_3 Plants' NO/sub x/ emissions and exhaust through the 291-A-1 and 296-U-4 stacks. Five DuPont 461 photometric analyzers continuously monitor the NO/sub x/ concentrations in the 291-A-1 stack and at three other points in the process, while another analyzer monitors the 296-U-4 stack. A KURZ EVA 4000 Electronic Velocity Array continuously monitors the airflow through the 291-A-1 stack, and an annubar continuously monitors the airflow through the 296-U-4 stack. 2 refs., 7 figs.

48308 **(WHC-SA—0175) Evaluation of ground-water redox conditions in basalt aquifers of the Hanford Site, southeast Washington.** Wallick, E.I.; Ford, B.H. (Westinghouse Hanford Co., Richland, WA (USA)). Feb 1988. Contract AC06-87RL10930. 26p. (CONF-880235—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014022/JAW.

From NWWA ground water geochemistry conference; Denver, CO, USA (16 Feb 1988).

The deep Columbia River Basalts, approximately 1000 m below the surface of the Hanford Site, are under consideration as a repository for high-level nuclear waste. Because radionuclide mobility is very low or nonexistant under reducing conditions, determination of in situ redox conditions is important for modeling of radionuclide transport to the accessible environment to determine site suitability. The Basalt Waste Isolation Project (BWIP) is seeking multiple lines of evidence to assess whether reducing conditions exist, and to determine the long and short term redox poising of the basalt aquifers along likely flow paths. Redox data for the basalt ground-water system from Pt electrode measurements, accessory mineralogy, and redox couples are presented along with laboratory and field data for oxygen uptake to suggest reducing conditions at a probable Eh of approximately {minus}0.400 v. Redox-couple equilibrium was demonstrated, except for methane-bicarbonate, in an intermediate (depth of 200 to 400 m) flow system containing recently recharged ground water. A slab model was constructed, showing that oxygen uptake by ferrous iron in the Cohassett flow top is sufficient to remove oxygen from 4 to 7 repository volumes of ground water. 10 figs., 2 tabs.

0540 Health And Safety

REFER ALSO TO CITATION(S) 48302, 48638, 48706, 49697, 49701

48309 **(LA-UR—88-177) Training and exercises of the Emergency Response Team at the Los Alamos Plutonium Facility.** Yearwood, D.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-880924—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005390/JAW.

From American Nuclear Society conference; Charleston, SC, USA (26 Sep 1988).

The Los Alamos National Laboratory Plutonium Facility has an active Emergency Response Team. The Emergency Response Team is composed of members of the operating and support groups within the Plutonium Facility. In addition to their initial indoctrination, the members are trained and certified in first-aid, CPR, fire and rescue, and the use of self-contained-breathing-apparatus. Training exercises, drills, are conducted once a month. The drills consist of scenarios which require the Emergency Response Team to apply CPR and/or first aid. The drills are performed in the Plutonium Facility, they are video taped, then reviewed and critiqued by site personnel. Through training and effective drills and the Emergency Response Team can efficiently respond to any credible accident which may occur at the Plutonium Facility. 3 tabs.

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 48593

48310 **(AAEC/E—655) Data transmission system for the centrifuge enrichment plant safeguards project.** Hesse, E.W. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Apr 1987. 22p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703948/JAW.

A novel data transmission system was developed to enable the Australian Safeguards Office (ASO) in Sydney to monitor remotely the running of an experimental enrichment facility at the Lucas Heights Reserch Laboratories, using Telecom telephone lines. The system allowed ASO to monitor the enrichment, flows and activity in sensitive areas of the plant by means of a master computer at ASO and a slave computer at Lucas Heights. The slave computer sent requested data and scanned video pictures to determine intrusive changes to the plant. Detailed descriptions of the transmission system and method of operation are given, together with an outline of experience obtained during a three-month surveillance of the facility.

48311 **(ANSTO/E—660) Quadrupole mass spectrometer system for nuclear safeguards applications.** Evans, P.J. (Australian Nuclear Science and Technology Organisation, Lucas Heights). Dec 1987. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703949/JAW.

An on-line enrichment monitor for nuclear safeguards-related surveillance of a pilot-scale gas centrifuge plant is described. This monitor utilises a quadrupole mass spectrometer to measure the isotopic composition of UF/sub 6/ in the feed and product gas streams. Details of the design and construction are given, and several difficulties are identified and discussed. Finally, the performance of this system is illustrated with typical results.

48312 **(BNL—41489) A variable scheduling technique for Office of Security Evaluations (OSE) inspections.** Allentuck, J.; Kok, K. (Brookhaven National Lab., Upton, NY (USA); Battelle Columbus Div., OH (USA)). 1988. Contract AC02-76CH00016. 7p. (CONF-880631—48). NTIS, PC A02. Order Number DE88015619/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

The Office of Security Evaluations (OSE) of the Department of Energy (DOE) is charged with evaluating the effectiveness of DOE safeguards and security programs and policies. This responsibility has been met by performing inspections on a fixed frequency at intervals established in 1984 by precedent. In the face of limited resources, and considering the major improvements in safeguards and security throughout the complex, one must now establish inspection frequencies on a more analytical basis. To satisfy this need a methodology has been developed for scheduling inspections at variable frequencies. Here inspection frequency of a facility is determined by (1) the facility's relative ranking based on risk management considerations, and (2) the resources available for inspection. A facility's relative rank in an inspection priority list of DOE facilities is based on a parameter which is a function of threat, vulnerability, and consequences (TVC). In addition to prioritizing facilities, inspection topics for a given facility can be established using the methodology. 4 tabs.

48313 **(DP-MS—86-087) Material control and accountability by process simulation with small talk.** O'Rourke, P.E.; Soper, P.D. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1986. Contract AC09-76SR00001. 8p. (CONF-860654—52). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014795/JAW.

From 27. annual meeting of the Institute of Nuclear Materials Management; New Orleans, LA, USA (22 Jun 1986).

A demonstration material control and accounting (MC&A) system has been written in Smalltalk for the IBM PC-XT computer using the methods environment from Digitalk, Inc. The system is designed to track uranium through a processing facility. The advantages of using a Smalltalk based process simulation to represent the data and code for material control and accounting systems are: (1) the facility operators understand the objects and transfer rules because they understand their process, (2) the MC&A system can be easily modified to reflect changes in facility operation, and (3) the MC&A system can be rapidly developed. Smalltalk is also an attractive language for development of expert systems which would stand alongside the MC&A system. The expert systems would be used to determine the cause of descrepancies. Our goal is an MC&A system which will detect an inventory difference as soon as it occurs and advise the facility operators of possible actions they should take. 3 refs.

48314 **(DP-MS—88-40) Resolution of shipper-receiver differences.** Weber, J.H. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 9p. (CONF-880631—26). NTIS, PC A02. Order Number DE88013778/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Every facility strives to comply with DOE order 5630.2 requiring independent and timely measurements between facility shipments. While it is desirable to resolve shipper-receiver (S/R) differences before processing any of the material, this is not always possible or practical. Two examples are discussed where there is an apparent measurement bias between the shipping and receiving facilities. This measurement bias persisted over several shipments resulting in more S/R differences outside the combined error limits than expected. For the first example, the receiver could not measure the material until processed. In the second example, the receiving facility made Nondestructive Analysis (NDA) measurements of the shipments before processing. However, shipments were closed by dissolution until a measurement problem with the dissolution required using the ND measurements for the next two shipments indicated the same size shipper-receiver difference. Individual items outside limits were identified and measured by an independent arbitrator. While no definite answer exists that will resolve shipper-receiver differences in all situations, the examples presented of studies and investigations to identify biases and verify the integrity of the measurements could be applied at other facilities. 2 figs., 1 tab.

48315 **(DP-MS—88-123) Isotope correlation verification of analytical measurements for dissolver materials.** Satkowski, J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 3p. (CONF-880631—19). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012710/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

An independent verification of analytical results for accountability measurements of dissolver materials can be performed using the Isotope Correlation Technique (ICT). ICT is based on the relationships that exist between the initial and final elemental concentrations and isotopic abundances of the nuclear fuel. Linear correlation functions between isotopic ratios and plutonium/uranium ratios have been developed for specific reactor fuels. The application of these correlations to already existing analytical data provides a laboratory additional confidence in the reported results. Confirmation is done by a test of consistency with historical data. ICT is being utilized with dissolver accountability measurements at the Savannah River Plant Laboratory. The application, implementation, and operating experience of this technique are presented. 1 ref., 2 figs.

48316 (INIS-BR—1147-Vol.2, pp 125-130) **Nuclear material control system of the Development Center of Nuclear Technology (CDTN).** Stasiulevicius, R. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The Brazilian Nuclear Energy Commission approved in 1982 the 2.02 Experimental Regulation with the objective of establishing the general principles for the control of nuclear materials and others. This Regulation is applied to the cases of acquisition, holding, use, production and transference of these materials or equipments. Considering the acquired experience in this area, since the installation of the IPR-R1 nuclear research reactor in 1960, and the importance of this type of control, the Nuclear Technology Development Center - CDTN of NUCLEBRAS implemented in 1983 one proper Nuclear Material Control System, whose description and performance obtained during four years of operation, constitute the scope of the present paper.

48317 (INIS-BR—1147-Vol.3, pp 11-19) **Control of sealed sources and equipments used in gammagraphy.** Sahyun, A.; Sordi, G.-M.A.A.; Biazzini Filho, F.L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The Radiation Protection Department of the IPEN-CNEN/SP, in 1987, formed a section incharged to control all radioactive material: a) received by the IPEN-CNEN/SP; b) produced by the IPEN-CNEN/SP; c) delivered from the IPEN-CNEN/SP. The aim of this section is to maintain a permanent control of all radioactive sources movement got at the IPEN-CNEN/SP. This control is performed with a microcomputer, trademark MICRODIGITAL, model TK3000 //e, 256 KBytes of memory, utilizing the TOTALWORKS program. This program permits to have the origin, char-

acteristics and address of the radioactive sources, its sites in the IPEN, its uses, etc. Already we have put in the microcomputer, the control of the sealed sources produced used in nondestructive test, the inspection control of the gamagraphy irradiator and the control of the depleted sources. The next step is to introduce in the computer the inspection of the remote control of the irradiator. The aim of this paper is to describe the control program that was already put on. This radioactive material control was started with the sealed sources used in gamagraphy because we believe that is the field with the most likelihood of accident in the population, and therefore it's that need the most hard control about the site and the performance of the irradiation facility.

48318 **(LA—11219) International safeguards for an automated MOX [mixed-oxide] fuel fabrication facility.** Pillay, K.K.S.; Stirpe, D.; Picard, R.R. (Los Alamos National Lab., NM (USA)). May 1988. Contract W-7405-ENG-36. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88015051/JAW.

This report presents details of our recent examination of international safeguards issue relevant to a state-of-the-art, mixed-oxide (MOX) fuel fabrication facility, located in the United States, which may be placed under International Atomic Energy Agency (IAEA) safeguards. The unique aspects of this study are: (1) recognition of a widespread industrial practice using a rather limited number of quality assurance measurements for the operator's materials accountancy system; (2) investigation of a bimonthly materials balance closing, which does not conform to timeliness goals of the IAEA but is dictated by the facility; and (3) consideration of the IAEA's need to optimize inspection resources. Assuming IAEA's accommodation of reasonable facility-specific limitations, we conclude that it is possible to achieve many of the IAEA safeguards goals, such as timely detection of both abrupt and protracted losses. However, likely constraints on IAEA inspection resources as well as limitations in present nondestructive assay techniques for verifying plutonium contents of large fuel assemblies would decrease the detection probabilities for several falsification strategies. 4 refs., 4 figs., 10 tabs.

48319 **(LA-UR—88-1993) A testbed for advanced materials control and accounting concepts.** Tisinger, R.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-880631—43). NTIS, PC A02. Order Number DE88014433/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Advanced concepts in materials control and accounting include distributed databases in a distributed process environment and on-line instrumentation. To test various ideas in this area, we developed a testbed consisting of three personal computers {PCs} with several input devices and suitable software. The principal design aspects being tested include database structure, communication between various network nodes, database update on the host, speed of transaction processing, data input from on-line instrumentation, and a user-friendly interface with the operator. An IBM PC/XT at the local level is used to collect data using a barcode reader and balance in a mockup glove box. These represent typical examples of simple on-line instrumentation in nuclear material facilities. Manual input to the PC/XT is through a keyboard, a mouse, and a voice microphone. This PC/XT communicates with a host PC/AT that serves to post transactions for a process area or wing of a facility. A second PC/AT represents the central computer that collects data from several distributed nodes and maintains the central database for analysis and report generation. Custom software is called PC/DYMAC, a materials accounting package developed by Robert Bearse in cooperation with Argonne National Laboratory-West under the direction and funding of the Los Alamos Safeguards research and development program. It was developed using dBaseIII PLUS but was compiled with FoxBASE{plus} under the Santa Cruz Operations XENIX operating system. 4 refs. 1 fig.

48320 **(LA-UR—88-1994) Secure transmission of shipper/receiver confirmatory measurements.** Tisinger, R.M.; Brumfield, T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-880631—42). NTIS, PC A02. Order Number DE88014432/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Shipper/receiver confirmatory measurements will be performed at Y-12 using equipment designed by Y-12 and the Safeguards Assay Group at Los Alamos. Equipment consists of three stationary NaI(Tl) gamma-ray counter arrays and a Digital Equipment Corporation Micro-11 processor for processing data. In the case of outgoing shipments, the counter data will be incorporated in a shipping file with other necessary documentation and transmitted to the intended recipient. In the case of incoming shipments, this station will receive a similar file from the sending organization. Protection of all data at the S/RD level is required. Transmission of the data files can be made point-to-point over telephone lines with proper encryption. Two commercial devices used in conjunction with a personal computer are being evaluated to provide secure communication endorsed by the National Security Agency (NSA). One device is the Gillaroo from P. E. Systems, Inc., and the other is the STU-III, which is available as a PC board or a standalone unit, whereas the STU-III is a Secure Telephone Unit with an RS-232 port for connection to a computer. In both cases, file encryption is performed in hardware using keys supplied by NSA. The prime advantage of this approach is a simplicity. Aside from key management, the whole operation can be automatically controlled by command files on the computer without involving additional interfaces with secure networks or mail systems. Additional benefits are rapid response, immediate confirmation of receipt of message, a communication channel independent of the shipment itself, and low cost.

48321 **(LA-UR—88-2043) A high-performance, low-density waste assay system.** Li, T.K.; Simmonds, S.M.; Ensslin, N.; Cowder, L.R.; Sprinkle, J.K.; Parker, J.L.; Hykel, M.N.; Bourret, S.C.; Garcia, D.L.; Kresge, J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-880631—36). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014424/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

We have developed a high-performance, low-density waste assay (LDWA) system for determining uranium content in low-density, low-Z waste materials within a short count time (typically, 120 s) and for detection of any uranium lumps that might exist in waste boxes. The LDWA system employs a far-field gamma-ray spectroscopy technique. The amount of {sup 235}U is determined by analyzing the 185.7-keV gamma ray from the waste box, which will be rotated during assay to smooth the spatial response. The detector is a high-resolution, high-purity germanium N-type coaxial unit. For a 120-s count time, the detection sensitivity of the LDWA is 0.03 g {sup 235}U and the precision (1{sigma}) for a 1.7-g {sup 235}U sample is 4.0{percent}. The assay accuracy arising from the effect of the vertical position or uranium is <10{percent}. For detection of any lumps of uranium that might exist in waste boxes, we have investigated the first application of enhanced alpha-particle-induced uranium x rays as a flag and demonstrated that they are increased dramatically as functions of mass and density of the uranium lumps. 5 figs., 3 tabs.

48322 **(SAND—85-2523-Rev.) Procedures for DOE-Navy exchange and approval of engineering information and material management required for production of W88-0/MK5 RBA.** Branson, N.A. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1988. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015828/JAW.

This report establishes the procedures whereby information pertaining to the W88-0/MK5 RBA, MK5 JTA, and associated test equipment configurations and nonconformances will be exchanged and approved by the US Navy and DOE agencies. Material management procedures common to the Navy and the DOE will be implemented according to the provisions agreed to and reported here. Parties to this agreement are: Department of the Navy Strategic Systems Program Office; Department of Energy Albuquerque Operations Office; Navy Contractor (Lockheed Missiles and Space Co., Inc.); Mason {ampersand} Hanger-Silas Mason Co., Inc., Pantex Assembly Plant; Los Alamos National Laboratory; and Sandia National Laboratories.

48323 **(SAND—88-0326C) A systematic method for protecting industrial production from sabotage.** Vannoni, M.G.; Kjeldgaard, E.A.; Varnado, G.B.; Hockert, J.W. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-880631—46). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014971/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

The USDOE initiated the Production Risk Evaluation Program (PREP) at Sandia National Laboratories (SNL) to assess quantitatively the potential for serious production disruption as the result of random failures, accidents, natural disasters, or sabotage at its facilities. SNL developed a procedure incorporating both network and fault tree models that identifies production vulnerabilities. For each production step, a steady-state flow model computes the "critical time," which is the maximum period a step can be shut down without preventing the system from achieving production goals. The critical time is then used in fault tree analysis to determine the failure modes that can stop the process for longer than this period. Modular logic modeling is used for constructing the fault trees. Equipment restorable within its critical time need not be considered critical even though it may perform significant work. The PREP models can be used to identify those plant areas to which a saboteur would need to gain access. A security strategy using graded protection based on a PREP analysis potentially could reduce security costs. PREP methods also provide quantitative insights to develop protection measures that do not infringe upon the liberties of personnel or complicate work practices. 2 refs., 1 fig.

48324 **(UCRL—98110) Protection planning and risk management at Lawrence Livermore National Laboratory.** Hunt, J.S.; Altman, W.D.; Hockert, J.W. (Lawrence Livermore National Lab., CA (USA)). 26 Jun 1988. Contract W-7405-ENG-48. 6p. (CONF-880631—25). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013093/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Effective safeguards and security management begins with comprehensive strategic planning that synthesizes protection objectives, threat information, existing protection capabilities, consequences of protection failure, and the costs and impacts of safeguards changes into cost effective protection strategies that adequately address credible threats. Lawrence Livermore National Laboratory (LLNL) has developed a structured risk management approach to safeguards and security planning that is designed to lead to protection strategies that are cost effective, meet the intent of Department of Energy (DOE) orders, balance protection needs with programmatic priorities, and acknowledge a level of residual risks that is not cost effective to eliminate. This risk management approach to safeguards decision making was used to develop the first DOE-approved Master Safeguards and Security Agreement (MSSA) that addresses all security interests at a major facility including: special nuclear material, classified information and materials, computer and communication security, and other DOE property. This risk management approach also provides the strategic basis for day-to-day management of the LLNL security program as well as the integration of safeguards programs upgrades. 2 refs., 2 figs.

48325 **(UCRL—98143) Overview of the integrated vulnerability assessment tool.** Al-Ayat, R.A.; Renis, T.A.; Matter, J.C.; Winblad, A. (Lawrence Livermore National Lab., CA (USA)). 22 Jun 1988. Contract W-7405-ENG-48. 7p. (CONF-880631—30). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014141/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Safeguards professionals need a single, comprehensive tool for evaluating safeguards effectiveness against theft of special nuclear material by many different adversaries: insiders, outsiders, and colluding insiders and outsiders. This paper describes a new integrated vulnerability assessment tool which is currently being tested and will be ready for release later this year. The tool consist of five modules: Integration System Manager, Facility Description, Insider Evaluation, Outsider Evaluation, and Collusion Evaluation. The Integration System Manager is designed to keep track of analyses completed and in progress, while the Facility Description Module allows the use to describe the facility targets and safeguards components. Information gathered by the Facility Description Module can then be used by the three evaluation modules. The Outsider Evaluation Module is an enhanced version of SAVI (Systematic Analysis of Vulnerability to Intrusion) that includes an expanded outsider threat spectrum, a faster path algorithm, and a neutralization model based on BATLE (Brief Adversary Threat Loss Estimator). The Insider Evaluation Module is based on a new model, and it includes extensive databases for adversary attributes and strategies; it also contains a reference detection database. Insider/Outsider Collusion will be limited to "hand-off" scenarios. This tool will provide a standard approach for evaluating safeguards effectiveness and for preparing Master Safeguards and Security Agreements at various DOE facilities. 5 refs., 4 figs.

48326 **(UCRL—98145) A computer model for identifying security system upgrades.** Lamont, A.D. (Lawrence Livermore National Lab., CA (USA)). 23 Jun 1988. Contract W-7405-ENG-48. 7p. (CONF-880631—32). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014147/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

This paper describes a prototype safeguards analysis tool that automatically identifies system weaknesses against an insider adversary and suggests possible upgrades to improve the probability that the adversary will be detected. The tool is based on this premise: as the adversary acts, he or she creates a set of facts that can be detected by safeguards components. Whenever an adversary's planned set of actions create a set of facts which the security personnel would consider irregular or unusual, we can improve the security system by implementing safeguards that detect those facts. Therefore, an intelligent computer program can suggest upgrades to the facility if we construct a knowledge base that contains information about: (1) the facts created by each possible adversary action, (2) the facts that each possible safeguard can detect, and (3) groups of facts which will be considered irregular whenever they occur together. We describe the structure of the knowledge base and show how the above information can be represented in it. We also describe the procedures that a computer program can use to identify missing or weak safeguards and to suggest upgrades. 1 ref., 1 fig.

48327 **(UCRL—98952) Optimizing man-machine performance of a personnel access restriction security system.** Banks, W.W.; Moore, J.W. (Lawrence Livermore National Lab., CA (USA)). 22 Jun 1988. Contract W-7405-ENG-48. 6p. (CONF-880631—23). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013106/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

This paper describes a human engineering design and analysis effort for a major security system upgrade at a DOE facility. This upgrade was accomplished by replacing an obsolete and poorly human engineered security screening booth with a new, user oriented, semiautomated, computer-based access control system. Human factors engineers assisted the designer staff in specifying a security access interface to physically and cognitively accommodate all employees which included handicapped individuals in wheel chairs, and several employees who were severely disabled, both visually and aurally. The new access system was intended to control entry into sensitive exclusion areas by requiring personnel to enter a security screening booth and interact with card reader devices and a-simple-to-operate access control panel system. Extensive man-machine testing with prototype mock-ups was conducted to assess human engineered design features and to illuminate potentially confusing or difficult-to-operate hardware placement, layout, and operation sequencing. These evaluations, along with the prototype mock-ups, provided input which resulted in a prototype which was easy to enter, operate, and understand by end users. This prototype later served as the design basis for the final systems design. 5 figs.

48328 **(WHC-SA—0192) Selected results for measuring holdup in oxide hoods and transfer lines at Hanford.** Jones, R.A.; Kerns, R.E. (Westinghouse Hanford Co., Richland, WA (USA)). Mar 1988. Contract AC06-87RL10930. 8p. (CONF-880352—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013664/JAW.

From INMM workshop on process holdup; Rockville, MD, USA (2 Mar 1988).

Physical inventories require quantifying the holdup in process equipment; one practical way of accomplishing this is measuring the gamma ray from plutonium ({sup 239}Pu). Field measurements of plutonium holdup in dry plutonium oxide hoods or process transfer lines is frequently biased low, due to the possibility of heavy loading causing severe self-attenuation of the gamma rays. An experiment was performed to determine the allowable loading limits for measuring plutonium holdup in dry oxide hoods. Field measurements of transfer lines in a plutonium production facility are frequently biased low due to the self shielding of the holdup material. Fixed and portable gamma ray measurements were made of 6-ft-long sections of pipe. The results of this comparison are being used as a correction factor for routine field measurements of piping in the production facility. 1 fig., 1 tab.

0560 Legislation And Regulations

REFER ALSO TO CITATION(S) 48231

48329 (INIS-BR—1147-Vol.2, pp 141-149) **International law the sea disposal of radioactive waste.** Damasceno, E. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The International Law, that throughout its treaties and conventions, seeks to regulate matters concerning mankind's interests, rarely attains its basic end, due to quick dynamics of the involved facts, and the complexity of the questions dealt with. The conflict of interests becomes difficult solution. The sea disposal of radioactive wastes, put into practice by those countries which make use in large scale of nuclear energy, is the main subject of this paper, under the International Law focus. Such study gives emphasis to expository remarks, instead of theoretical doctrine, with the undeniable purpose to provoke the debate, under the light of the supremacy of Nature's interests. The London Dumping Convention (1972) and the U.N. Convention on the the Sea Law (1982) receive in this work an objective analysis in view of the theme's unavoidable length.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

REFER ALSO TO CITATION(S) 49252

48330 **Liquid-phase thermal diffusion isotope separation apparatus and method having tapered column.** Rutherford, W.M. (to Dept. of Energy, Washington, DC). US Patent 4,746,426. 24 May 1988. Filed date 4 Dec 1985. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A thermal diffusion apparatus for separating isotopes suspended in a solution is described comprising: a vertical first wall having a first temperature; a vertical second wall disposed substantially adjacent the first wall, and arranged to diverge from the first wall toward a bottom of the first and second walls, thereby defining a slit between the first and second walls which tapers bottom to top, the second wall having a second temperature substantially different from the first temperature; means, in fluid communication with the slit, for introducing the solution into the slit; and means, in fluid communication with the slit, for maintaining a flow of solvent from the bottom to the top of the slit.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 48317

48331 **(CONF-880911—6) Comparison of the diffusion and transport calculations for the Advanced Neutron Source reactor.** Azmy, Y.Y.; Difilippo, F.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012915/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

We performed six-group two-dimensional, r-z criticality calculations for a previous candidate design for the Advanced Neutron Source (ANS) reactor using a diffusion theory code (BOLD-VENTURE) and a transport code (DORT). Several quantities of practical interest in the design of the ANS were evaluated from the converged solution and compared to one another. The relative difference between the diffusion and transport estimates of these quantities was also compared to a recently obtained estimate of the accuracy of the transport calculation itself in order to evaluate the diffusion approximation. Our results confirmed that most diffusion calculated quantities are sufficiently accurate with the error mostly arising from the finite size of the computational cells rather than from the underlying theory. 8 refs., 4 figs.

48332 **(IAEA-TECDOC—454) Technical and economic comparison of irradiation and conventional methods. Final report of an advisory group meeting held in Dubrovnik, Yugoslavia 6-8 October 1986.** (International Atomic Energy Agency, Vienna (Austria)). Apr 1988. 189p. (CONF-8610432—). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88703833/JAW.

From Advisory group meeting on technical and economic comparison of irradiation and conventional methods; Dubrovnik, Yugoslavia (6 Oct 1986).

Radiation processing is based on the use of ionizing radiation (gamma radiation, high energy electrons) as a source of energy in different industrial applications. For about 30 years of steady growth it became almost routine in a number of industrial processes. The growth resulted, among other things, from the availability of radiation sources matching requirements of industrial production and from the wide basis of fundamental and applied radiation research. The most important, however, was the fact that radiation processing proved in practice to be safe, reliable, easy to control, and economical. In comparison with other competitive techniques, it also offered a better alternative from the viewpoint of occupational safety and environmental considerations. In order to review the current status of comparative analysis of radiation and competitive techniques from the technological and economic viewpoint, the Agency convened an Advisory Group in Dubrovnik, Yugoslavia, 6-8 October 1986. The present publication is based on contributions presented at the meeting, discussions held at the meeting, and subsequent editing work. It is expected that this updated technological and economic comparative analysis will provide useful information for all those who are implementing or considering the introduction of radiation processing to industry. The presented data may be essential for decision makers and could contribute to all feasibility and pre-investment studies. As such, this publication is expected to promote industrially oriented projects based on radiation processing techniques. The actual figures given in the individual reports are as accurate as possible. However, it should be understood that time factor and local conditions may play a significant role and corresponding adjustment may be required. Refs, figs and tabs.

48333 (IAEA-TECDOC—454, pp 87-109) **Crosslinking of heat shrinkables, plastic tubes and moulded parts.** Wiesner, L. (Beta-Gamma-Services, Odenthal (Germany, F.R.)). Apr 1988. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88703833/JAW. (CONF-8610432—).

From Advisory group meeting on technical and economic comparison of irradiation and conventional methods; Dubrovnik, Yugoslavia (6 Oct 1986).

After a short review of the basis of the crosslinking technology by physical and chemical methods, a detailed technical com-

parison of the relative merits of the different crosslinking processes is made with regard to their range of applicability, differences in process parameters and in properties of the crosslinked products. The result of this analysis shows that radiation crosslinking offers the greatest potential in the development of new and better materials for numerous applications on account of its applicability to a wide range of polymers. A further advantage of radiation crosslinking is the freedom to choose the degree of crosslinking appropriate to the required performance of a given product. Unique possibilities are provided by radiation crosslinking in special applications. Among them, the manufacture of products with locally different material properties by varying the degree of crosslinking is particularly mentioned. As for the economic aspects of radiation processing, it is emphasized that its great potential lies in the substitution of more expensive materials by crosslinked low-cost polymers. As the economic feasibility of radiation processing is limited to facilities with large installed irradiation capacities, contract irradiation centers treating the products of numerous customers assume the role of pacemakers for the utilization of the manifold technical advantages of radiation crosslinking. (author). 17 refs, 7 figs, 1 tab.

48334 (IAEA-TECDOC—454, pp 111-122) **Radiation crosslinking of polymers in the wire and cable industry.** Studer, N. (Studer AG, Daeniken (Switzerland)). Apr 1988. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88703833/JAW. (CONF-8610432—).

From Advisory group meeting on technical and economic comparison of irradiation and conventional methods; Dubrovnik, Yugoslavia (6 Oct 1986).

Electron beam crosslinking of wire and cable insulation has gained a secure place in industries in North America, Japan and, partially, in Europe. This has been achieved as a result of several factors which made possible the development of radiation technology: the significant amount of knowledge accumulated on radiation chemistry and physics of polymers, availability of adequate radiation sources matching industrial requirements in throughput and reliability, and the growing market for crosslinked products. The decision to use radiation technology or some other process has always been made on the basis of technological and economic considerations. The present contribution compares the electron beam technology with several of the most common chemical crosslinking techniques: peroxide, monosil and sioplas (silane) crosslinking. The comparison is based on actual industrial experience. (author). 39 refs, 4 figs, 1 tab.

48335 (IAEA-TECDOC—454, pp 125-176) **Comparison of heat, UV and radiation curing.** Wendrinsky, J. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Apr 1988. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88703833/JAW. (CONF-8610432—).

From Advisory group meeting on technical and economic comparison of irradiation and conventional methods; Dubrovnik, Yugoslavia (6 Oct 1986).

Radiation curing chemistry has a number of applications in industry, and has emerged as one of the rapidly developing technologies in the late '70s. Because only limited penetration is required for surface curing applications, low energy electron beams (typically 150-300 kW) are generally used. The advantage is that these machines are available in relatively compact, self-shielded configurations and can be installed easily in existing or new manufacturing lines. The development of the technology and industrial acceptance was also greatly facilitated by the availability of ready-made formulations for a variety of applications. The radiation curing technique is compared here with two other main alternative methods: heat curing and curing by UV light. Several case studies are described in detail. (author). 69 refs.

48336 (IAEA-TECDOC—454, pp 179-188) **Disinfection of sewage sludges by gamma irradiation and alternative methods.** Lessel, T.H. (Abwasserverband Ampergruppe, Eichenau (Germany, F.R.)). Apr 1988. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88703833/JAW. (CONF-8610432—).

From Advisory group meeting on technical and economic comparison of irradiation and conventional methods; Dubrovnik, Yugoslavia (6 Oct 1986).

Sewage sludges generally maintain high concentrations of pathogens. For their safe reutilization on agriculturally used areas a disinfection treatment is necessary. Conventional methods for this purpose are e.g. heat-treatment (pasteurization), composting and lime-treatment. A new technique for sludge disinfection is the irradiation treatment by gamma-rays or by accelerated electrons. The first practical plant for gamma-irradiation of sewage sludges has been in operation since 1973 in Geiselbullach, near Munich, Federal Republic of Germany. This paper summarizes the existing and projected plants for the sewage sludge disinfection by irradiation and names the conventional alternative methods with their main advantages and disadvantages. The techniques for irradiation and sludge handling in irradiation plants are described. Broad research work in Geiselbullach with the aim of operational and economic optimization led to a combined treatment of irradiation and oxygenation: the oxiradiation-treatment. The costs for gamma-irradiation and alternative treatments for sewage sludge disinfection are given. Finally the problems with gamma irradiation plants are discussed. (author). 1 ref., 2 figs, 1 tab.

48337 (INIS-mf—11300) **Industrial radiographic applications.** Bilge, N.A.; Tugrul, B.; Sungur, F. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy). 1986. 8p. (In Turkish). (CONF-8610433—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703918/JAW.

From Industrial cooperation in the field of nuclear technology; Istanbul, Turkey (15 Oct 1986).

X-rays, gamma rays and neutrons can be used for industrial radiographic applications. In this study, the techniques are determined and explained for different type of applications. Detailed informations are given by related radiographs from our studies in this field. Importance of the radiographic techniques are determined for quality assurance and quality control procedures.

0704 Economics

REFER ALSO TO CITATION(S) 48332

08 HYDROGEN

48338 (NRC/E—031982) **Hydrogen and energy storage. Status report, April 1982.** (National Research Council of Canada, Ottawa, Ontario. Div. of Energy; National Research Council of Canada, Ottawa, Ontario. Div. of Chemistry). Mar 1982. 59p. (CE—01719). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes research programs conducted under a national Canadian program to investigate and improve energy storage systems and techniques and hydrogen energy systems. Under each project are described the state of the art, research objectives, rationale for the project, progress to date, and future plans. In the field of energy storage, projects are presented in the areas of flywheel storage, thermal storage, chemical heat pumps, high temperature materials, electrochemical storage, and advanced secondary batteries. In the field of hydrogen systems, projects involve hydrogen production by electrolysis and thermochemical processes, hydrogen storage, fuel cells and hydrogen safety and embrittlemenet. 3 figs., 1 tab.

0801 Production

48339 (PIRSEM—3037) **Metabolism of hydrogen in a photosynthetic bacterium and in an aerobic bacterium.** Vignais, P. (Centre National de le Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matieres Premieres). 1986. 5p. (In French). NTIS (US Sales Only), PC A02/MF A01; GPO Dep. Order Number DE88754620/JAW.

The genetic mapping of the Rhodopseudomonas capsulata chromosome is studied. Three groups of genes involved in nitrogen fixation have been identified. Their mapping is different of the map-

ping of the nif genes in klebsiella pneumoniae. The regulation of the nitrogen fixation in R. capsulata is also investigated and the R-prime plasmids which bear regulating genes are isolated.

0805 Safety

48340 **(LA-UR—88-2045) Safety aspects of large-scale handling of hydrogen.** Edeskuty, F.J.; Stewart, W.F. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 14p. (CONF-880925—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014422/JAW.

From Hydrogen today; Moscow, USSR (25 Sep 1988).

Since the decade of the 1950s, there has been a large increase in the quantity of hydrogen, especially liquid hydrogen, that has been produced, transported, and used. The technology of hydrogen, as it relates to safety, has also developed at the same time. The possible sources of hazards that can arise in the large-scale handling of hydrogen are recognized, and for the most part, sufficiently understood. These hazard sources are briefly discussed. 26 refs., 4 figs.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 48078, 48386, 48387, 48753, 48804

48341 **(AERE-R—12946) Municipal solid waste conversion to energy: a summary of current research and development activity in Canada.** Dent, C.; Krol, A. (UKAEA Harwell Lab. Environmental and Medical Science Div.). May 1988. 265p. H.M. Stationery Office, London, price Pound 13.00.

A report written as part of the MSW conversion activity Task IV, IEA Biomass Energy Agreement.

Work carried out on the use of municipal solid waste for conversion to energy under Task IV of the IEA Bioenergy Agreement is reported. The three participating countries are Sweden, Canada and the UK. The Canadian practices with respect to landfill gas and direct incineration of the wastes are analyzed. Refuse derived fuels and pyrolysis of the waste are also included. Suggestions are made for possible collaborative research programmes.

48342 **(DOE/PC/90533—7) Deactivation by carbon of iron catalysts for indirect liquefaction: Quarterly technical progress report for period March 16, 1988--June 15, 1988.** Bartholomew, C.H. (Brigham Young Univ., Provo, UT (USA)). 18 Aug 1988. Contract FG22-86PC90533. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015635/JAW.

Construction of a computer-automated reactor system to be used in the kinetic and deactivation studies was completed. The control language, control routines, and software for operating this system were essentially completed. Progress was also made on the operating manual and testing of the system. CO hydrogenation activity/selectivity tests were conducted on unsupported iron catalysts reduced at 300 or 400{degree}C. Deactivation leading to loss of surface area was experienced after rereduction at 400{degree}C. 47 refs., 5 figs., 4 tabs.

48343 **(ORNL/Sub—84-90435/1) Hydrocarbons and energy from plants: Final report, 1984-1987.** Calvin, M.; Otvos, J.; Taylor, S.E.; Nemethy, E.K.; Skrukrud, C.L.; Hawkins, D.R.; Lago, R. (Oak Ridge National Lab., TN (USA); Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC05-84OR21400. 161p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88015328/JAW.

Plant hydrocarbon (isoprenoid) production was investigated as an alternative source to fossil fuels. Because of their high triterpenoid (hydrocarbon) content of 4--8%, Euphorbia lathyris plants were used as a model system for this study. The structure of the E. lathyris triterpenoids was determined, and triterpenoid biosynthesis studied to better understand the metabolic regulation of isoprenoid production. Triterpenoid biosynthesis occurs in two distinct tissue types in E. lathyris plants: in the latex of the laticifer cells; and in the mesophyll cells of the leaf and stem. The latex has been fractionated by centrifugation, and it has been determined that the later steps of isoprenoid biosynthesis, the conversion of mevalonic acid to the triterpenes, are compartmentized within a vacuole. Also identified was the conversion of hydroxymethyl glutaryl-CoA to mevalonic acid, catalyzed by the enzyme Hydroxymethyl glutaryl-CoA Reductase, as a key rate limiting step in isoprenoid biosynthesis. At least two isozymes of this enzyme, one in the latex and another in the leaf plastids, have been identified. Environmental stress has been applied to plants to study changes in carbon allocation. Salinity stress caused a large decrease in growth, smaller decreases in photosynthesis, resulting in a larger allocation of carbon to both hydrocarbon and sugar production. An increase in Hydroxymethyl glutaryl-CoA Reductase activity was also observed when isoprenoid production increased. Other species where also screened for the production of hydrogen rich products such as isoprenoids and glycerides, and their hydrocarbon composition was determined.

48344 **(PB—88-217013/XAB) Trace constituents in landfill gas. Task report on sampling and analysis, Final report, May 1984-May 1986.** Flynn, N.W.; deLappe, B. (SCS Engineers, Inc., Covington, KY (USA)). Mar 1988. 123p. (R—58403). NTIS, PC A06/MF A01.

See also PB—88-217021.

The report represents the results of tasks performed for the Gas Research Institute (GRI) program entitled Evaluation of Gas Cleaning Technologies for Trace Constituent Removal. The report summarizes Tasks I-2 (Refine Existing and Develop New Technologies for Sampling and Analysis of Trace Constituents) and II-1 (Field Test Existing Gas Cleaning Technologies). Additional task reports for this GRI program are published separately. Methane produced by the decomposition of urban refuse in sanitary landfills is an immediately available alternative fuel. The gas can be removed from landfills, processed, and utilized by technology that is currently available or under development. GRI member companies are presently involved in major landfill gas recovery projects in Alabama, California, Illinois, New Jersey, New York, and Oregon. The objectives of these project tasks were: (1) to outline and verify sampling and analytical protocols for measuring halogenated, sulfonated, and other organic compounds at trace concentrations in landfill gas; and (2) to evaluate on a cost-effectiveness basis, existing gas treatment technologies for efficiency of trace-constituent removal.

48345 **(PB—88-217021/XAB) Trace constituents in landfill gas. Task report on inventory and assessment of cleaning technologies. Final report, May 1984-February 1987.** Keller, A.P. (SCS Engineers, Inc., Covington, KY (USA)). Apr 1988. 140p. NTIS, PC A07/MF A01.

See also PB—88-217013.

The objective of these tasks in the overall GRI study was to establish if a landfill gas (LFG) processing scheme was able to economically treat LFG to pipeline quality, and satisfactorily meet applicable environmental regulations. Through the course of the study, most of the commercial acid-gas removal processes used in the oil, gas, and chemical industries were discussed and categorized. Those processes which appear to be the most appropriate for use in treating LFG are described in the report. The most-economically attractive process for LFG treatment was found to be the methanol wash process. Methanol wash resulted in the lowest capital and operating costs. The process described in the study is non-licensed, non-proprietary, and open for design by any skilled engineer. Following the economic analysis on the overall process, it has been concluded that it is feasible to economically process LFG to meet pipeline-quality standards providing that certain minimum requirements are met.

48346 **(PB—88-219811/XAB) Measurement of methanotroph- and methanogen-signature phosopholipids for use in assessment of biomass and community structure in model systems.** Nichols, P.D.; Mancuso, C.A.; White, D.C. (Florida State Univ., Tallahassee (USA). Dept. of Biological Science). 1987. 14p. NTIS, PC A03/MF A01.

Pub. in Organic Geochemistry, Vol. 11, No. 6, 451-461(1987).

Methanotrophic biomass and community structure were assessed for a soil column enriched with natural gas. An increase in microbial biomass, based on phospholipid ester-linked fatty acids (PLFA), was apparent for the natural gas-enriched column relative to a control column and untreated surface soil. Following GC-MS analyses of the derivatized monounsaturated fatty acids, the major component (22% of the PLFA) of the natural gas-enriched column was identified as 18:1 delta 10C. The relatively novel fatty acid has only been previously reported as a major component in methanotrophs. Its presence in the soil, together with other supportive evidence, implies that the microbial metabolic group makes a large contribution to the column flora. Other microbial groups were also recognized and differences compared between the soils analyzed.

48347 **(PIRSEM—0257) Structure of the algae kerogens, their formation and evolution.** Casadevall, E. (Centre National de le Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matieres Premieres). 1984. 34p. (In French). NTIS (US Sales Only), PC A03/MF A01; GPO Dep. Order Number DE88754610/JAW.

The formation of the algae kerogens, their transformation in petroleum and the criteria for the coupling of the kerogen structure, their evolution rate and their petroleum potential are studied, especially the Torbanite and Coorongite kerogens produced by Botryococcus braunii. These kerogens are formed essentially from a biopolymer present in the initial organic matter, the sporopollenine (a resistant polymer). The presence of this resistant polymer is detected and investigated in the two Botriococcus braunii varieties (A and B).

48348 **(PNL—6614) Biomass thermochemical conversion program: 1987 annual report.** Schiefelbein, G.F.; Stevens, D.J.; Gerber, M.A. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1988. Contract AC06-76RL01830. 44p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015405/JAW.

The objective of the Biomass Thermochemical Conversion Program is to generate a base of scientific data and conversion process information that will lead to establishment of cost-effective processes for conversion of biomass resources into clean fuels. To accomplish this objective, in fiscal year 1987 the Thermochemical Conversion Program sponsored research activities in the following four areas: Liquid Hydrocarbon Fuels Technology; Gasification Technology; Direct Combustion Technology; Program Support Activities. In this report an overview of the Thermochemical Conversion Program is presented. Specific research projects are then described. Major accomplishments for 1987 are summarized.

48349 **(PNL-SA—15986) Catalytic hydrotreating processes for upgrading biocrude oils.** Elliott, D.C.; Baker, E.G. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 12p. (CONF-8806176—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013187/JAW.

From Thermochemical conversion program review meeting; Golden, CO, USA (21 Jun 1988).

Catalytic hydrotreating of wood-derived liquids is being studied using a continuous-feed, fixed-bed reactor. Commercial hydrotreating catalysts and conditions are used to hydrodeoxygenate and hydrocrack the biocrude oils generated by high-pressure processing. Biocrude oils from atmospheric flash pyrolysis require alternate processing to first stabilize the products prior to catalytic hydrotreating. Experiments are performed in an upflow reactor wherein both liquid-phase and gas-phase reactions are considered to be important. Although hydrocarbons are not produced in any significant amount by thermochemical direct liquefaction of wood, the use of a secondary hydrogenation step to treat the initial product can result in nearly pure hydrocarbons. These hydrocarbons are primarily cyclic alkanes and aromatics which would be useful in gasoline bending. 10 refs., 3 figs., 6 tabs.

48350 **(PNL-SA—15994) Thermochemical conversion of high-moisture biomass feedstocks.** Butner, R.S.; Sealock, L.J. Jr.; Elliott, D.C.; Neuenschwander, G.G. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 10p. (CONF-8806176—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014072/JAW.

From Thermochemical conversion program review meeting; Golden, CO, USA (21 Jun 1988).

A catalytic process for the conversion of high-moisture (>50 wt % moisture) biomass and related waste materials to medium-Btu gas is being developed by Pacific Northwest Laboratory (PNL). The process, which employs a commercial supported nickel catalyst at temperatures of 350{degree}C to 450{degree}C, has been demonstrated in a 1-L batch autoclave reactor. More than a dozen feedstocks, including aquatic plants, herbaceous energy species, agricultural residues, and food processing wastes have been successfully tested. High methane yields have been obtained from many of these feedstocks, and the calorific value of the raw product gas ranges from 350-560 Btu/scf. A 1-L continuous reactor system has been constructed and will be used to obtain necessary engineering data required for scaleup of the process. The major accomplishment since the last contractor's review is the design and fabrication of a 1-L continuously fed reactor system capable of processing up to 4 L/h of biomass slurry at reaction conditions comparable to those employed in the batch reactor system. The continuous reactor system will be used to study the isothermal rate behavior of the catalytic system and to determine the effects of reaction conditions on product yield and quality. 10 refs., 1 fig., 2 tabs.

48351 **(PNL-SA—15999) Upgrading liquid products: Notes from the workshop at the international conference research in thermochemical biomass conversion.** Elliott, D.C. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 8p. (CONF-880518—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88014767/JAW.

From International conference on research in thermochemical biomass conversion; Phoenix, AZ, USA (2 May 1988).

A workshop was held at the International Energy Agency conference, Research in Thermochemical Biomass Conversion, on the subject of upgrading liquid products. The workshop discussion focused on the two prominent methods of liquids upgrading, catalytic hydroprocessing and catalytic cracking. Catalytic hydroprocessing as applied to biomass liquids relies heavily on petroleum developed technology; similar catalysts and operating conditions are used, although lower space velocities are typical. The need for stabilization of the pyrolytic products prior to hydroprocessing was also discussed. Catalytic cracking of biomass liquids also relies heavily on petroleum processing technology. Zeolite catalyst development has focused on the ZSM-5 of Mobil and its application to pyrolysis products. Significant olefinic gas yields are obtained in the zeolitic processing of biomass pyrolyzates and the conversion of these to liquid fuels is a primary research goal. Aromatic gasoline is the primary product in both catalytic processes. A general conclusion of the workshop participants was that the cost of liquid fuels for internal combustion engines would be higher in the foreseeable future. Due to the high cost of initial biomass liquefaction plants (including upgrading) a more likely near-term product would be aromatic chemicals produced under constrained economic circumstances. 16 refs.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 48753

48352 **(AFME—83-359) Direct liquefaction of biomass.** Bouvier, J.M.; Gelus, M.; Girard, B.; Lamy, P.Y.; Maugendre, S. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1984. 65p. (In French). NTIS (US Sales Only), PC A04/MF A01; GPO Dep. Order Number DE88754613/JAW.

The direct liquefaction of wood through a solvolysis process is studied. The dissolution of wood is obtained in smooth conditions

(T=240C, residence time of 20 to 30 minutes) in presence of an acidified solvent medium (phenol and water). The operating conditions are optimized in order to reduce the solid residual matter. The obtained fuel is a complex mixture of aromatic molecules, thermally non stable and having a high oxygen content. The fuel hydrocracking is also studied and a small scale pilot plant has been constructed.

48353 **(AFME—83-360) Hydrosolvolysis.** Bourgeois, J.P. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1984. 23p. (In French). NTIS (US Sales Only), PC A03/MF A01; GPO Dep. Order Number DE88754612/JAW.

The process of hydrosolvolysis of roast wood has been tested and optimized for the liquefaction of wood. The roast wood powder is introduced in a low pressure hydrosolvolysis reactor with ethylantraquinone as a catalyst. The solvent is Acropol 35 and the hydrogenating agent is pure hydrogen. The role of the different agents in the hydrosolvolysis is investigated.

48354 **(DOE/ER/13604—4) Study of synthesis gas conversion over metal oxides: Progress report, August 1, 1987-July 31, 1988.** Ekerdt, J.G. (Texas Univ., Austin (USA). Dept. of Chemical Engineering). Jul 1988. Contract FG05-86ER13604. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014731/JAW.

The goals of this program are to develop an understanding of the causes for catalytic activity and selectivity, and an understanding of the effects of metal oxide structure and acidic and basic additives on CO hydrogenation over metal oxides. The research has focused on synthesis gas conversion over zirconium dioxide to produce branched hydrocarbons and alcohols, isosynthesis. Reaction mechanisms have been identified by the use of infrared spectroscopy, transient reaction techniques, and carbon-13 and oxygen-18 isotope labelling. Isosynthesis is characterized by two competing growth steps, CO insertion and condensation between methoxide and enolates. Surface oxygen anion vacancies have been identified as the active site for CO activation by various adsorptive and reactive titrants. Current work is focused on alkali hydroxide/, Al_2O_3/, Sc_2O_3/, Y_2O/sub 3//, Sm_2O_3/, and La_2O_3/ZrO_2 systems. Conversion of CO to methanol, 2-alcohol dehydration, and labelling studies, which establish the relative rates of CO insertion versus condensation, are used to probe the catalytic properties of these systems. 24 refs., 7 figs., 2 tabs.

48355 **(PIRSEM—2058) Automatization and optimization of ethanol production through fermentation with reactor in series.** Goma, G.; Sevely, Y. (Centre National de le Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matieres Premieres). 1985. 16p. (In French). NTIS (US Sales Only), PC A03/MF A01; GPO Dep. Order Number DE88754611/JAW.

This study has been conducted by biotechnicians in conjunction with automaticians in order to develop a continuous ethanol production system through fermentation with reactors in cascade and possibility of distributed feeding. The physiology of the alcoholic fermentation and of the continuous culture fermentation in multi-staged reactors is described. The processes are then modelized and the command control system is designed. Instrumentation and computer codes are described. A pilot plant composed of four fermentation tuns in series have been constructed.

48356 **(SA—031982) Analysis of ethanol production potential from cellulosic feedstocks.** Stone, J.E. (Railway Association of Canada, Canadian Pacific Ltd., Montreal, Quebec). Mar 1982. 60p. (CE—01705). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report provides a comprehensive and scientific overview of results emerging from research on ethanol producton from cellulosic materials and indicates those areas which appear to warrant additional support. Many published economic analyses of production costs are examined, but the emphasis of the report is on research and on its potential for reducing the cost of ethanol production. The author concludes that the uncertainty surrounding the cost of producing ethanol from cellulosic feedstocks via enzymatic hydrolysis will not be resolved until a pilot plant has been built of sufficient size to produce realistic engineering data. He gives five reasons why Canada should build such a pilot plant: Canada's apparent leadership in developing a steam pre-treatment process, the desirability of encouraging developments and building a cadre of experts in biotechnology, the absence of a pilot plant in Canada where the various organisms and biochemical processes involved in ethanol production and by-product utilization can be developed on a reasonably large scale, Canadian expertise in lignin chemistry which might be used to capitalize upon the reactive lignin residue, and research in progress at National Research Council and elsewhere on the conversion of C/sub 5/ sugars to ethanol. 37 refs., 2 figs., 4 tabs.

48357 **(SAND—88-7092C) Direct methane conversion: An assessment.** Gray, D.; Tomlinson, G.; Shen, J. (Mitre Corp., McLean, VA (USA); USDOE, Washington, DC). 1988. Contract AC04-76DP00789. 6p. (CONF-880912—6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010225/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

If its were possible to convert methane directly to methanol or higher hydrocarbons with high conversion and selectivity, both the steam reforming and methanol synthesis steps could be eliminated. This direct conversion approach has the potential for considerable savings in cost if technically sound processes can be developed. Interest in direct methane or natural gas conversion has recently intensified worldwide. Several approaches to this are being researched at oil companies and in programs funded by the Department of Energy or the Gas Research Institute. The more technically advanced processes are those that operate in the temperature range 600-800{degrees}C. This paper assesses the technical potential of some of these high temperature direct methane conversion approaches being researched by various groups. These new approaches are then compared to the conventional technology for converting methane to gasoline by utilizing steam reforming, methanol synthesis and Mobil's Methanol-to-gasoline (MTG) technology. The direct methane conversion approaches analyzed in this report are Oxidative Coupling, partial oxidation, and Oxyhydrochlorination. Table I summarizes the known process parameters and calculated conversion efficiencies for the new direct methane conversion approaches and the baseline technology considered in this analysis. Using the preliminary data available, the computer simulations of the new approaches all show overall system efficiencies that are not greatly different from the conventional technology.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 48341, 48382, 48386, 48387, 48842, 48976, 49345

48358 **(DOE/CE/40714—T1) Waste tire utilization.** Hershey, R.L.; Waugh, M.D.; Hanny, E.J. (Science Management Corp., Washington, DC (USA)). 30 Apr 1987. Contract AC01-84CE40714. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015215/JAW.

Waste tire accumulations have become an increasingly important problem in recent years. This is of interest to DOE because the scrapped tires represent a large energy resource, and many requests for information have been received. Therefore, this report has been prepared to help in implementing waste tire utilization technologies.

48359 **(DOE/CS/40402—T6) Co-firing of refuse-derived fuel (RDF) with natural gas in a cement kiln: Summary of test results.** Reed, J.E.; Conrad, J.L.; Price, C.D. (Energetics, Inc., Columbia, MD (USA)). Mar 1983. Contract AC01-80CS40402. 101p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88015217/JAW.

In July of 1986, the Environmental Equipment Corporation, in association with the Portland Cement Association and the Gulf Coast Portland Cement Company, initiated a program to develop and test refuse-derived fuel (RDF) on a commercial scale as a sup-

plemental energy source for the portland cement industry. The objectives of the work performed were to definitely determine the technical and operational limits on the use of RDF, and to develop and test the equipment and systems required by cement plants to use RDF on a full-time commercial basis. Three extended trial burns were completed with satisfactory results at the Gulf Coast Portland Cement Company's plant in Houston, Texas. Prior to these tests, the kiln was normally fired with natural gas to produce clinker by the wet process. During the trial burns, 20%, 30%, and 40%, respectively, of the heat input was supplied by RDF. Each test lasted approximately three days, in all producing 8500 tons of cement while burning 1338 tons of RDF. Analyses of the cement clinker, kiln feed, flue dust, ash, precipitator dust, and cooler dust by an independent testing authority -- the Portland Cement Association -- showed acceptable clinker quality and acceptable environmental data. Although some loss of cement product strength was encountered in the third (i.e., 40% RDF) test, this may have been due to an inadvertent, temporary loss of temperature control.

48360 **(DOE/OR/21390—20) Great Lakes Regional Biomass Energy Program: Quarterly report, March 1, 1988-May 31, 1988.** Bancroft, D. (Council of Great Lakes Governors, Inc., Madison, WI (USA)). Jun 1988. Contract FG05-83OR21390. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88014530/JAW.

This is the third quarterly report of the fifth year of operation of the Great Lakes Regional Biomass Program. Stressing near-term biomass feedstock production techniques and conversion processes, the objective of the program is to increase the use of biomass energy by the public and private sectors in the seven state Great Lakes region. The Great Lakes Regional Biomass Energy Program is divided into three separate operational programs. The first is the State Grant Program, which provides resources to the seven state energy offices in the region to increase their capabilities in biomass energy. State-specific activities and interagency programs are emphasized in the State Grant Program. The second, the Subcontractor Program,involves the letting of subcontracts to private organizations to address regional biomass issues and needs. The third is the In-House Technology Transfer Program in which Council staff develop biomass energy publications and reports. Heavy emphasis is being placed on air quality impacts resulting from the direct combustion at various biomass feedstocks. The Iowa Department of Natural Resources conducted a second series of particulate emissions tests at a high school boiler burning corncobs in an effort to bring it into compliance. The Wisconsin Division of State Energy testified before the Wisconsin Department of Natural Resources on the extent of toxic emissions from industrial-scale wood combustion. Both the Michigan Public Service Commission and the Minnesota Department of Public Service are hiring consultants to assist them in addressing air quality consensus surrounding the combustion of MSW. Emissions is also a topic of regional concern in which Pacific Environmental Services was selected as subcontractor to perform a series of air quality analyses on the combustion of densified refuse derived fuels.

48361 **(DOE/OR/21390—T12) Directory of intermediate Btu biomass energy combustion equipment (250,000 to 10,000,000 Btu/hr): Manufacturers and distributors.** (Council of Great Lakes Governors, Inc., Madison, WI (USA); National Wood Energy Association, Portsmouth, NH (USA)). 1988. Contract FG05-83OR21390. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015068/JAW.

This directory contains information provided by the companies that manufacture or distribute biomass energy combustion equipment. It is a catalog of such equipment.

48362 **(IMR—111981) Wood chip fuel for residential use.** (Institute of Man and Resources, Ottawa, Ontario (Canada)). Nov 1981. 71p. (CE—01688). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A 3-year large scale furnace demonstration was conducted in Prince Edward Island to encourage the substitution of sustainable wood fuel supply systems for imported oil. Wood chip fired heating systems were installed in rural homes to demonstrate the feasibility of residential heating using wood chip fuel, to determine the optimum methods of chip fuel harvesting, storage and handling, and to provide participating homeowners with the education and training necessary to harvest their own wood chip fuel. The homeowners reacted very positively to the demonstration. The wood chip preheater performed well; there were no difficulties connecting it to roundwood furnaces or boilers. The wood chip heating system is very clean burning even in low fire conditions. The concept of rural homeowners chipping their own wood fuel in conjunction with a forest management plan has proved feasible. No major problems were found in storing wood chip fuel in house basements. Existing safety and installation codes may need to be reviewed to optimize the efficiency of a wood-fired heating system installed in conjunction with an oil-fired unit. Providing a chimney and flue appropriate for wood fuel use can be a major expense in heating system conversion. This report also includes an operator's manual for a wood chip preheater/gasifier. 10 refs., 12 figs., 6 tabs.

48363 **(IMR—111981) Wood pellet fuel for residential use.** (Institute of Man and Resources, Ottawa, Ontario (Canada)). Nov 1981. 50p. (CE—01689). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A 3-year large scale furnace demonstration was conducted in Prince Edward Island to encourage the substitution of sustainable wood fuel supply systems for imported oil. Wood pellet warm-air furnaces were installed in urban and suburban residences, to demonstrate feasibility and to determine the best methods of pellet fuel processing, delivery, storage, and handling. Further objectives were to develop a preliminary commercial infrastructure to support residential pellet fuel supply systems, and to test a performance-based incentive concept as a means of financing renewable energy technology capital costs. Major conclusions during the first year are as follows. Sufficient pellet fuel for a winter heating season can be stored in a small basement. Delivery in 12-tonne loads costs $21-$33/tonne depending on weather; bagged fuel delivery cost $40/tonne. Pneumatic delivery using an agricultural feed truck proved feasible, although further work is needed to refine the technique. An attempt to establish a pellet production plant on the Island was unsuccessful. Pellet dust was the most troublesome aspect of delivery and loading. The pellet stoker is simple and convenient to use. Bin-fed stokers which reduce fuel handling are preferable to hopper-fed stokers. None of the pellet furnaces in the demonstration produced creosote in flues, only light ash. Attention should be given to better ash handling methods for pellet burners. The unsubsidized cost of pellet fuel, made in Maine and transported 480 km, was close to the cost of No.2 light fuel oil. 7 refs., 12 figs., 4 tabs.

48364 **(PB—88-216320/XAB) Slash-harvesting system. Forest Service project report.** Krischuk, J. (Forest Service, San Dimas, CA (USA). Equipment Development Center). Jul 1986. 29p. (PR—8651-1204). NTIS, PC A03/MF A01.

With current logging practices, a significant amount of residue (slash) is left on the forest floor. This slash is a fire hazard, a source of insect infestation, and it inhibits reforestation. One alternative for reducing the fire hazard and for recovering slash is development of a slash harvesting system, consisting of slash bundlers, slash concentrators, and a skyline slash grapple and rake. Once recovered, slash could be burned at the landing or ultimately transported for use as fuel. Before transporting, slash is usually converted to chips for loading into a chip van. This allows for greater load volume and a more usable form, which reduces transportation costs.

13 HYDRO ENERGY

REFER ALSO TO CITATION(S) 48930

48365 (OME—2121983, pp 23) **Policy and activities. Ontario Hydro.** Mikhail, N. (Ontario Hydro, Canada). 2 Dec 1983. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum. (CE—01648; CONF-8311312—).

From Small hydro workshop; Toronto, Canada (30 Nov 1983).

This paper covers the approval of the installation of private, parallel generation systems in Ontario from the perspective of Ontario Hydro, the publicly owned electric utility. If the owner of a small hydro system wishes to interconnect with Ontario Hydro's grid, there are a number of procedures to follow which are outlined in this report, starting with presentation of plans to the appropriate department. Ontario Hydro inspects and tests various aspects which would affect the overall electricity system. The supply/demand situation of the private system has to be considered, and the decision rule is normally to meet domestic requirements first and sell the excess to the most convenient distribution utility (of which there are 321 in Ontario). Contractual arrangements as to electricity purchases then have to be entered into; basic technical criteria have to be met before interconnection can proceed, to ensure the safety and quality of electricity in the distribution system. Metering equipment must be installed. Wheeling, i.e. transmission by a private owner to the owner's own remote site without selling to Ontario Hydro, is another possibility. Current policy is to consider such requests on a case by case basis; rquests should be not difficult to accomodate as long as both locations are within Ontario Hydro's operating jurisdiction. This report ends by describing some small hydro developments using the new Mini-Hydel technology at two locations in Wasdell Falls and Sultan. An outline is also made of the 1984 rate structure and principles for purchasing electricity from private generation. 2 tabs.

1301 Resources And Availability

48366 **(CRIE-U—87008) Analysis of pore pressure behavior of a rockfill dam during reservoir filling.** Nakagawa, Kameichiro; Matsui, Ietaka. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Sep 1987. 31p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753443/JAW.

This paper reports on the analysis of the behavior of Doyoh Dam of Matanogawa Power Plant of Chugoku Power Electric Co., in accordance with the water level change at the initial filling and the operation. The procedure of the analysis is the finite element analysis of the coupled process between the deformation of the dam and the penetrating flow. The results are as follows: 1. Physical properties were rechecked by comparing the calculation and the measurement of the behavior at the initial construction of the dam in order to well express the further behavior, and reevaluation of the input characteristics in the early stages was found important for improved accuracy. 2. It is predicted that the reservoir filling influences the distribution of the residual pore pressure after the construction. But the initial filling does not elevate the residual gap water pressure. 3. Calculation shows that the change of water level of the dam during the plant operation causes pore pressure movement in the core which is not so serious as to affect the stability of the dam. (19 figs, 6 tabs, 1 ref)

1303 Plant Design And Operation

48367 **(DOE/ID/12128—2) Jackson Bluff Hydroelectric Project: Final operation and maintenance report.** Hinton, J.; deMontmollin, F. (Tallahassee, City of, FL (USA); Department of Energy, Idaho Falls, ID (USA). Idaho Operations Office). Mar 1988. Contract FC07-80ID12128. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number TI88015360/JAW.

The Jackson Bluff Hydroelectric Project is the first hydroelectric plant developed by the City of Tallahassee. The project is located on the Ochlockonee River approximately 66 miles upstream from its mouth at the Gulf of Mexico and approximately 20 miles west-southwest of the city of Tallahassee, Florida. The original hydroelectric generating facility with a total capacity of 8800 kw was retired in 1970. In the late seventies, the Department of Energy (DOE) classified the site as potential site for the Hydroelectric Demonstration Project. The City of Tallahassee submitted a proposal to DOE to reinstall generating equipment and operate the facility. The proposal was approved and after a feasibility study, the City was granted $1.75 million by DOE to meet approximately 15{percent} of the total project cost. The existing powerhouse and intake serves to utilize three vertical-shaft turbines, two fixed blade and one adjustable blade propeller (Kaplan). The two fixed blade turbines drive a 4440 kw synchronous generator each and the adjustable blade propeller drives a 3438 kw synchronous generator. The plant design flow is 5200 cubic feet per second and the rated net head for the turbines is 32 feet. The runner diameters are 125.8 inches (fixed blade) and 104.7 inches (adjustable blade). In early 1983, with the proposal approved and the feasibility study completed, the City of Tallahassee took over the responsibility of the project. The rehabilitation work started in July 1983, and was completed in early 1986.

1305 Economics And Management

REFER ALSO TO CITATION(S) 48760

48368 **(OME—2121983) Small Hydro Workshop '83. The business of small hydro.** (Ontario Ministry of Transportation and Communications, Ottawa (Canada)). 2 Dec 1983. 196p. (CE—01648; CONF-8311312—). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

From Small hydro workshop; Toronto, Canada (30 Nov 1983).

This workshop presented papers on small scale hydroelectric plants in Ontario, from the perspective of economic feasibility and evaluation. A review of some installed projects and demonstration programs is also presented. Some topics deal with legal and regulatory matters. Separate abstracts have been prepared for ten papers from this workshop.

1306 Environmental Aspects

48369 **(PB—88-213145/XAB) Research on fish protection at Dutch thermal and hydropower stations.** Hadderingh, R.H.; Koops, F.B.J.; van der Stoep, J.W. (Keuring van Electrotechnische Materialen N.V., Arnhem (Netherlands)). 1988. 18p. NTIS, PC E03/MF A01.

Pub. in Kema Scientific and Technical Reports, Vol. 6, No. 2, 57-68(1988). See also PB—88-150334.

Power stations need large amounts of water for condenser cooling. Substantial numbers of predominantly young fish are entrained with the cooling-water flow. Considerable mortality rates may occur, both of the fish caught on the cooling-water screens and of the larvae passing through the cooling-water circuit from the intake to the outfall. A sampling program of impinged fish from the cooling-water screens for eight power stations showed that the numbers of impinged fish were highest at the Bergum power station (situated at a lake) and lower at the river power stations. Experiments on preventing fish from entering the cooling-water intakes were carried out with light, air bubbles, electrical screens and orientation objects.

14 SOLAR ENERGY

48370 **(AFME—82-059-1) Introduction of the renewable energies in the Developing country French aid program.** (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1983. 88p. (In French). NTIS (US Sales Only), PC A05/MF A01; GPO Dep. Order Number DE88754622/JAW.

A projective study over the 1980-1990 concerning the two-sided and multi-sided cooperation and aid program between France and developing countries is presented for the solar energy aspect. The various application domains are examined: rural development, industry and mining, transportation, electricity production, telecommunications, professional training, city equipment, health, tourism and cultural activities. The financial modalities and methods are drawn-up and compared.

48371 **(NRC/E—NRCC23526) Solar Energy Program contract registry, 1983-1984.** (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). Jul 1984. 227p. (CE—01745). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This document covers all contracts issued by the Solar Energy Program, National Research Council of Canada, that were either completed or ongoing from August 1, 1983 to April 30, 1984. The contracts have been grouped into five categories: residential active, passive, commercial/industrial process heat, photovoltaics, and core applications. Within each category contracts are grouped according to the type of study. The general categories are: technical, economic, and information studies; materials, technology, and product development; systems development; simulation and design tools; performance evaluation; and test methods and standards. Description of project objectives, and results to date (if any), are given for each project. A publication section contains a listing of reports which have recently been published by the Solar Energy Program, a list of pertinent Division of Building Research publications, and information on ordering all reports referenced in the Reports and Reference Sources sections on the summary sheets. An index of contractors is also included.

1401 Resources And Availability

48372 **(CMHC—041982) Modelling of off-axis houses in CMHC-2.** Tremayne, M.A. (Canada Mortgage and Housing Corp., Ottawa, Ontario). Apr 1982. 36p. (CE—01725). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents a technique for modelling houses which are not oriented exactly north, south, east, or west. By implementing the technique within the CMHC-2 program, a greater sensitivity to house siting will be achieved. The level of solar radiation striking the walls and windows of a house is dependent upon its orientation. The CMHC-2 program currently contains solar radiation data for vertical surfaces of N.S.E.W. directions. The presented technique fits a sine curve to portions of the solar data, to determine the solar radiation level on vertical surfaces of a house of any orientations. The presented technique should be implemented within the CMHC-2 program. With this technique, a more realistic modelling of a house may be achieved. The average accuracy of the calculated values is within 3.1% and 8.4% of the published solar radiation values, for the heating and cooling season respectively. The accuracy during the heating season is acceptable since the solar radiation is a secondary effect upon the heating requirements of a house. The CMHC-2 program has been developed primarily for the estimation of heating requirements of houses. When the estimation of cooling requirements of houses is introduced into the program, the significance of the accuracy of the technique during the cooling season should be reviewed. 1 ref., 14 figs., 9 tabs.

48373 **(CMHC—071982) Modelling of air temperature data for use in CMHC-2.** Parsons, L.J. (Canada Mortgage and Housing Corp., Ottawa, Ontario). Jul 1982. 78p. (CE—01726). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The long-term hourly drybulb temperature data for Ottawa, Vancouver and Saskatoon were mathematically analyzed in order to develop simple correlations for temperature differentials which can be used in the CMHC-2 computer program to model the thermal performance of houses. The relationships developed will significantly improve the precision of thermal heat loss analysis in the program. The best approach, (the power curve), was chosen based on a rigorous mathematical analysis and computer simulation of the alternative mathematical techniques. The recommended technique is simple to implement, produces accurate results, is concise in its storage requirements and is comprehensive in its ability to define the temperature differential causing heat flow through a building envelope. Further work is required to develop mathematical relationships to define the heating temperature differentials for 58 other Canadian sites, and the cooling temperature differentials for all 61 sites. 3 refs., 24 figs., 13 tabs.

48374 **(EPRI-AP—5883) Photovoltaic resource assessment in Colorado: Final report.** Emslie, W.A.; Dollard, C.J. (Electric Power Research Inst., Palo Alto, CA (USA); Platte River Power Authority, Fort Collins, CO (USA)). Jul 1988. 198p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88014503/JAW.

Platte River Power Authority undertook this Photovoltaic Resource Assessment Project in order to quantify the amount of insolation available for photovoltaic power production in the north central Colorado region. The project is designed to measure insolation received by several orientations used for solar energy collection, including two axis tracking, fixed tilt, and an adjustable tilt surface, which is repositioned on a monthly basis. 18 figs., 7 tabs.

48375 **(NP—8770374) Results obtained from measuring solar radiation in the Federal Republic of Germany as well as from special measuring series performed at the Hamburg Meteorological Observatory. Vol. 11(1986).** (Deutscher Wetterdienst, Hamburg (Germany, F.R.). Meteorologisches Observatorium). 1987. 133p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770374/JAW.

Numerous, very comprehensive tables contain the results of solar radiation measurements in West Germany and of special measuring series of the Meteorological Observatory of Hamburg. Additional information is provided on radiation (measuring quantities, measuring units, network of stations, explanations of tables) and material carried by the air such as aerosol mass concentration, giant particles (concentration of free hydrogen ions and water-soluble inorganic ions), large particles, Aitken particles, precipitation (quantity, pH value, electric conductivity), near-ground ozone, nitrogen oxide, sulfur dioxide, as well as predominant wind directions. Tables are drawn up for 28 measuring sites (from Schleswig to Constance), according to months, and indicate the total length of diffuse solar radiation in days and hours (mean values of decades and months, monthly extremes). (HWJ).

1403 Economics

REFER ALSO TO CITATION(S) 48418

48376 **(DCA—111982) Financing solar supplementary hot water systems. Issues and alternatives.** (D'Craz (J.R.) and Associates, Willowdale, Ontario (Canada)). Nov 1982. 103p. (CE—01666). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study addresses the "tilt" problem in financing supplementary solar hot water heating systems (SSWHS): energy cost savings are back-end loaded, i.e. they increase in real terms over time, whereas financing cash flows decrease. Thus, investments in solar installations may appear unattractive from a cash-flow viewpoint even when they make sense on a life-cycle cost basis. The study examined whether alternative financial instruments could be developed to overcome the tilt problem and whether Canadian financial institutions would be willing to offer financing on these terms. Legal and institutional questions about design of such financing were investigated by interviewing those in the financial field. Computer models were developed to simulate financial patterns for a range of cases covering SSWHS installations by different types of owners. The basic conclusion is that there is no evidence that a financing problem exists for SSWHS; the basic problem is that such systems are currently uneconomic because they cost too much and do not save enough on fuel costs to justify their installation. Such systems are economic only when subsidized via capital cost allowance provisions in the tax system. A major finding of the study is that the timing of installation is critical to project economics. Financial institutions have been found willing to make loans for SSWHS and commercial/industrial retrofit loans, large enough to warrant special treatment, can be designed to match cash flow patterns to energy cost savings. However, financing could suffer be-

cause financial institutions are unfamiliar with SSWHS economics and technology. 13 tabs.

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 48403

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 48341, 48343, 48346, 48348, 48350, 48351, 48356, 48362, 48374, 48414, 48710, 48711, 48835, 49255, 49649, 49684

48377 (AD-A—193249/0/XAB) Solar-cell modeling and simulation. Technical report. Marvin, D.C. (Aerospace Corp., El Segundo, CA (USA). Chemistry and Physics Lab.). 5 Feb 1988. 30p. (TR—0086A(2945-01)-6). NTIS, PC A03/MF A01.

An important aspect of solar-cell design and analysis is the ability to model the wide variety of structures presently under study. This document reports on the application of the Poisson and Continuity Solver (PISCES) semiconductor modeling code to solar-cell studies. The original program supplied by Stanford University was modified to include optical-generation processes as required and to correct a number of significant programming errors. In its present form, nearly all solar-cell structures proposed can be simulated by PISCES, as well as a variety of other opto-electronic devices and processes. The material parameters which may be adjusted include, but are not restricted to, doping profiles, bulk, interface and surface recombination characteristics, and contact properties such as ohmic, Schottky, or insulating. The major model selections available include Boltzmann or Fermi-Dirac carrier statistics, voltage or current boundary conditions, and steady-state or time-dependent analyses. The program capabilities are demonstrated by analysis of several state-of-the art solar-cell designs in which the important design parameters are varied and their effect on the cell output parameters shown.

48378 (AFME—82-0200-2) Acid pretreatment and enzymatic hydrolysis of various ligno-cellulosic materials. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1984. 68p. (In French). NTIS (US Sales Only), PC A04/MF A01; GPO Dep. Order Number DE88754616/JAW.

The effects of the pretreatment conditions (acidity of the liquid, temperature, pressure, residence time), of the hydrolysis conditions (enzyme concentration, dry matter concentration, presence of a prehydrolyzate) and of the type of lignocellulosic matter on the enzymatic hydrolysis rate and yield. Two types of cellulase are tested; the lignocellulosic matters are: corn stalks, wheat straw, small pieces of beech and eucalyptus.

48379 (AFME—85-06-1022) Feasibility study of a calibration method with a reference sun. Bertrand, G. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1986. 55p. (In French). NTIS (US Sales Only), PC A04/MF A01; GPO Dep. Order Number DE88754623/JAW.

The solar cell energy sensibility measure is investigated. The energy sensibility may be obtained through the spectral sensibility measure with a monochromatic illuminator and a radiometer. Two measuring methods are proposed, one for the linear cells (application to small scale cells (up to some square centimeters), the other one for the non-linear cells (up to 44 centimeters aside). The equipment characteristics are precised: instruments, costs, adjustments, precision, etc....

48380 (DOE/OR—21390-T18) Short-rotation wood production systems for marginal land in the Great Lakes region: Final report. Majerus, K.A. (Illinois Univ., Urbana (USA). Dept. of Forestry). 1986. Contract FG05-83OR21390. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015077/JAW.

Over the long-term, short-rotation wood production systems can provide a sustained supply of wood as a renewable energy resource. Short-rotation forestry is an alternative to conventional agriculture on marginal land. Since several harvests occur from a single planting, short rotation systems provide relatively permanent vegetation. The potential for improved land use and resource conservation exists in conversion of marginal land to short-rotation systems. Short-rotation forestry involves fast-growing, deciduous woody species planted at close spacings and harvested over short time periods (4 to 10 years). Harvested trees resprout from established rootstocks and supply wood through coppice production. Tree planting densities from 5000 trees/ha to 10,000 trees/ha appear favorable. Thirteen species seem promising for the Great Lakes region (Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, Wisconsin). Average annual yields in the US have been 8 to 9 dry Mg/ha. Maximum yields on good sites with optimum species have been 20--30 dry Mg/ha yr. Annual yields on marginal sites are expected to range from 4 to 15 dry Mg/ha considering both seedling and coppice productivity. Recommendations are discussed for short-rotation wood production on marginal land in the region. 38 refs., 6 figs., 6 tabs.

48381 (DOE/OR/21390—T10) The literature of biomass energy production: A bibliography: Final report. Campbell, G.E.; Clark, S.A. (Illinois Univ., Urbana (USA). Dept. of Forestry). 20 Oct 1986. Contract FG05-83OR21390. 142p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88015066/JAW.

The bibliography of biomass references is arranged by subject and alphabetically by author. References covering a particular topic can be found in two ways. The first method is to simply locate the subject of interest within the "Table of Contents" to find the appropriate page numbers. It is important to check all relevant subject areas, since many papers contain material which overlap the formal areas of classification used here. This is because references are only listed once in the bibliography. The second method is to look in the "Author Index" for authors who have worked in your area of interest. The scope of the bibliography is quite large, covering published material related to biomass energy production from the entire United States and, in some cases, abroad. Regional papers (i.e., applied material specific to the seven-state Great Lakes region) are identified with an asterisk in the left margin.

48382 (DOE/OR/21390—T11) Industrial wood energy information survey: Final report. King, H. (Council of Great Lakes Governors, Inc., Madison, WI (USA)). May 1986. Contract FG05-83OR21390. 151p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88015070/JAW.

The purpose of this survey was to obtain a better understanding of the information needs of businesses and public institutions in the Great Lakes region that may convert to wood fuel as their primary energy source. To gain the most accurate understanding of these information needs, three different categories of businesses and public institutions were contacted. The first category consisted of wood-fuel users. The second category was composed of businesses and public institutions that do not use wood fuel but would consider converting. The third category included the respondents that do not use wood fuel and would not consider converting.

48383 (DOE/OR/21390—T16) Environmental impacts of harvesting wood for energy: Great Lakes Regional Biomass Energy Program. Johnson, J.E.; Pope, P.E.; Mroz, G.D.; Payne, N.F. (Council of Great Lakes Governors, Inc., Madison, WI (USA)). Mar 1987. Contract FG05-83OR21390. 169p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88015080/JAW.

This book overviews the environmental effects of timber harvesting practices on wild life, plant life, soil, and water. It concludes with a discussion of management practices which could alleviate detrimental environmental impacts. 258 refs., 38 figs., 50 tabs. (JF)

48384 (DOE/OR/21390—T19) An economic assessment of short-rotation forestry and herbaceous crop production for energy feedstocks on marginal land in the Great Lakes region: Final report. Campbell, G.E.; Majerus, K.A. (Illinois Univ., Urbana (USA). Dept. of Forestry). 1986. Contract FG05-83OR21390. 100p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88015076/JAW.

The economics of producing biomass for energy feedstocks on marginal land in the Great Lakes region are considered for several short-rotation forestry and herbaceous crop production systems. Short-rotation alternatives vary by tree spacing, rotation length, and intensity of weed control. Variation in yield resulting from differences in site quality is the primary variable for herbaceous alternatives. To conserve soil on marginal sites, perennial species are recommended. Production parameters for both systems are based on average conditions found for marginal land assuming tract sizes of between 100 to 500 acres. Two decision criteria are used: cost per million Btu and annual net return. Future cash flows are discounted with a real interest rate of 6 percent. Cost per million Btu ranges from $1.51 to $2.93 for short-rotation wood production. The break-even price for the 4 {times} 4 ft short-rotation spacing is $44.00 per dry ton. Energy costs for herbaceous systems range form $1.96 to $5.43 per million Btu. Assuming medium herbaceous yields, the break-even price is $38.00 per dry ton. Harvest costs are currently the highest production cost for short-rotation wood. Production parameters considered most important to the economics of perennial herbaceous energy crops include fertilization, harvesting, land and yield. Thus, for both short-rotation forestry and herbaceous crop production, harvest and land costs are critical. However, the cost of planting stock is found more important for short-rotation systems while fertilizer costs are more important for herbaceous crop production. 39 refs., 21 figs., 27 tabs.

48385 **(DOE/OR/21390—T20) Biomass production for energy feedstocks on marginal land in the Great Lakes region: Executive summary: [Final report].** Campbell, G.E.; Majerus, K.A. (Illinois Univ., Urbana (USA). Dept. of Forestry). 1986. Contract FG05-83OR21390. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015075/JAW.

This report summarizes a study which assessed the suitability of marginal land in the Great Lakes region for energy feedstock production. The study area comprised the following states: Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin. Three feedstock systems were considered for marginal land including the collection of agricultural crop residues, production of herbaceous energy crops, and short-rotation wood production. 22 refs., 1 figs., 22 tabs.

48386 **(DOE/OR/21390—T21) Rural and marginal land in the Great Lakes Region: Final report.** Majerus, K.A. (Illinois Univ., Urbana (USA). Dept. of Forestry). 1986. Contract FG05-83OR21390. 104p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88015073/JAW.

The land resource considered most attractive for energy crop production systems in the Great Lakes region involves land considered marginal for conventional agriculture. Production of perennial herbaceous energy crops and short-rotation woody species has good potential for improved soil conservation compared to annual row-cropping. This study assessed the regional land resource involving rural acres in Land Capability Classes IV–VII (based on the SCS 1982 NRI). Data analyses were performed for both non-federal, public and private lands, with a focus on privately owned marginal land. The location, distribution, and characteristics of private, marginal land were examined at the regional, state, and MLRA level. The 47 million private acres of marginal land distributed within Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin were evaluated in terms of Land Capability Classes, present land uses, and Capability Subclasses. Data compilations include descriptive, tabular, and map presentations for the seven states. Land conversion to perennial energy crop production systems seems most feasible for the 5.8 million private, marginal acres of cropland in Classes V and VI, and pastureland in Class VI. Class VIII land is most likely inappropriate for energy crops. Class IV land has the potential to provide renewable biomass energy resources but competition with food crop production becomes a factor for this class. Ultimately, land use decisions must be based on site evaluations in the field if long-term resource conservation to be achieved. 8 refs., 14 figs., 18 tabs.

48387 **(DOE/OR/21390—T22) Ownership characteristics, production barriers, and landowner attitudes toward producing biomass for energy feedstocks on marginal land in the Great Lakes region: Final report.** Campbell, G.E. (Illinois Univ., Urbana (USA). Dept. of Forestry). 11 Aug 1986. Contract FG05-83OR21390. 169p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88015072/JAW.

Rural landowners in the seven-state Great Lakes region were interviewed by telephone during the summer of 1985 to assess: the land ownership pattern for marginal land; the barriers to biomass production on marginal lands; and the attitudes of landowners toward the growing of energy feedstocks. Three biomass production systems were considered: the collection of agricultural crop residues, herbaceous crops grown exclusively for energy, and short-rotation forestry.

48388 **(FRNC-TH—2848) Contribution to the study of dynamic behaviors of anaerobic thermophilic cellulolytic bacteria.** Poulain; Van de Walle, M. (Institut National des Sciences Appliquees (INSA), 31 - Toulouse (France)). 1984. 136p. (In French). NTIS (US Sales Only), PC A07/MF A01; GPO Dep. Order Number DE88754628/JAW.

Mixed microorganism cultures were enriched with thermophilic cellulolytic bacteria, during the hydrolysis they produce mainly acetic acid. A comparative study of the kinetics is conducted between a mixed culture and a clostridium thermocellum phylum. An optimum inoculum-substratum ratio is revealed. It is shown that the cellular concentration is highly limited and that the fermentation products (ethanol, acetic acid) are not the principal growth inhibitors. Substrate turnover and fermentation ultrafiltration tests have proved that toxic substances exist which, when released progressively during substrate degradation, may have an inhibition effect.

48389 **(HFS—P-257) Silvicultural treatments to maximize biomass production in aspen stands.** Horton, B.J. (Horton Forestry Services Ltd., Stouffville, Ontario (Canada)). May 1984. 20p. (CE—01738). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Aspen, the common "weed tree" of the Boreal Forest, reproduces by root suckers after logging or fire, forming clones which average some 0.1 ha in area. Superior clones can be several times more productive than inferior, considering biomass, stem size, disease resistance, etc. Methods for classifying clones were tested in Petawawa stands of trembling and largetooth aspen. Treatments designed to expand good clones and inhibit poor clones were applied experimentally in mature and immature stands. First-year results proved promising in terms of expandability of favoured clones. 6 refs., 5 figs., 4 tabs.

48390 **(LU—ENFOR101982) Uses of nitrogen fixation and other root symbioses for biomass production. Progress report, 1981-1982.** Fortin, J.A. (Laval Univ., Quebec City (Canada)). Oct 1982. 90p. (CE—01703). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objective of the research was to examine ways of using nitrogen fixation and mycorrhizal symbioses in intensively managed forests to increase biomass production and maintain soil fertility with minimal use of energy-demanding fertilizers. In order to achieve this objective it is necessary to study and understand the organisms and the processes involved, and their relationship with vegetation and other components of the soil. This progress report describes the history of the establishment of the plantations and their condition after one year's growth. In particular the report describes the soil characteristics, as well as a preliminary estimate of growth, of biomass, and of concentrations of nutrients in the trees. 27 refs., 16 figs., 30 tabs.

48391 **(NP—8770369) Polycondensates on the basis of renewable raw materials. Final report.** (Bayer A.G., Leverkusen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1987. 49p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770369/JAW.

In the course of this BMFT-sponsored project, a large number of new polycarbonates and copolycarbonates as well as some polyesters and copolyesters were synthesized from renewable raw materials, e.g. dian hydrosorbit, a starch product, and limonene from the peels of tropical fruits.

48392 **(NP—8770382) Development and testing of a pilot reactor for enzymatic hydrolysis of cellulose-containing waste.** Borchert, A. (Deutsche Gesellschaft fuer Chemisches Apparatewesen, Chemische Technik und Biotechnologie e.V. (DECHEMA), Frankfurt am Main (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1985. 22p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770382/JAW.

Enzymatic hydrolysis of cellulose- and pectin-containing waste materials requires simple reactors and a simple, adaptable technology. The conversion process was studied with a view to reactor design, using a discontinuous trickle-bed reactor and a continuous spiral-shaft reactor, each with a volume of 50 l. Both reactors are based on the tube reactor principle, which had already been tested on a small scale in an earlier project. The substrates were potato pulp, shredded beetroot, and pretreated wheat straw. Enzyme mixtures for these substrates were chosen with a view to achieving good yields within 48 h at the most. The main parameters were the time of residue, temperature, enzyme adsorption and stability, and an experimental procedure with or without partial recirculation of the reaction products.

48393 **(NRC/E—NRCC23776) Tissue culture and micropropagation for forest biomass production.** Mason, E.; Maine, F.W. (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). Sep 1984. 84p. (CE—01751). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

An increase in forest production will be necessary in the future when wood becomes a major renewable source of energy and chemicals along with its traditional role of fibre source. This increase could eventually by achieved be proper selection and breeding of trees. Clonal forestry by vegetative propagation of cuttings is becoming a viable alternative to a seedling-based forestry with many advantages, and cutting could be used to quickly propagate large numbers of clones of control-pollinated seedlings. Most forest trees are propagated sexually and seed orchards were started in the US and Canada in the last 40-50 years for breeding purposes. Forests could ultimately be established with improved seedlings instead of from seed with unknown genetic potential, or by natural regeneration. Micropropagation is the term used to refer to the propagation of plants raised by tissue culture methods rather than from seeds or cuttings. Many clonal plantlets could be regenerated asexually in the laboratory and eventually transplanted to permanent sites. In addition the technology could be developed to produce new variants from somatic cells. Tissue culture is a technique which may be useful for plant propagation where conventional methods are inadequate or unsuitable. However, traditional studies of field planting observed over long periods of time would still be necessary. This document has the object of informing those who may wish to know more about these techniques in relation to practical application, and require a general overview rather than experimental details, which are given in an annotated bilbiography. 274 refs., 2 figs., 1 tab.

48394 **(PIRSEM—2087) Study of the structure of the Botryococcus exocellular polysaccharides and of the regulating factors for the hydrocarbon production.** Casadevaal, E. (Centre National de le Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matieres Premieres). 1985. 7p. (In French). NTIS (US Sales Only), PC A02/MF A01; GPO Dep. Order Number DE88754619/JAW.

The objectives of this study were to evaluate the production rate of exocellular polysaccharides in a Botryococcus braunii unicellular algae culture as a function of the age of the culture and to determine if a relation between hydrocarbon production and polysaccharide production exists. The chemical structure of the polysaccharides is studied. With the view of an industrial production, the utilization of polysaccharides as a by-product is also investigated.

48395 **(SAND—88-1249) Analysis of steam injected gas turbines for solar thermal applications.** Linker, K.L. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014191/JAW.

The Department of Energy's (DOE) Solar Thermal Program has as one of its program elements the development and evaluation of heat engine technologies that are applicable to Distributed Receiver Systems. The primary research and development activities, for the past several years, have involved the dish--electric concept in which a heat engine, solar receiver, and generator are combined as a power conversion assembly (PCA) and mounted at the focus of a parabolic dish concentrator. PCAs based on Rankine, Brayton, and Stirling cycle heat engines have been designed and built at 10{endash}25 kWe power levels with varying degrees of success. The small Brayton cycle engines in particular have fallen short of expectations as a focal mounted PCA. This report analyzes larger Brayton engines (500 kWe and above) supplied with fossil fuel and solar energy from 15-m diameter parabolic dishes or small central receivers. In particular, a steam injected gas turbine (STIG) cycle is examined because of its ability to offer higher efficiencies as compared to the combined cycle, regenerative Brayton cycle, and water injected Brayton cycle. This report outlines quantitatively the cycle parameters that affect efficiency for a solar-augmented steam-injected gas turbine. 15 refs., 18 figs., 2 tabs.

48396 **(SAND—88-8000) 10 MW/sub e/ solar thermal central receiver pilot plant receiver performance: Final report.** Baker, A.F. (Sandia National Labs., Livermore, CA (USA)). Aug 1988. Contract AC04-76DR00789. 108p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88015368/JAW.

This report uses experimental data to evaluate the performance of the 10 MW/sub e/ Solar Thermal Central Receiver Pilot Plant receiver. Receiver performance includes such receiver characteristics as point-in-time steady state efficiency, average efficiency, receiver life, start-up time, operations time, and operations during cloud transients. The receiver peak steady state efficiency, calculated by two different methods, before December 1985 was about 77%. After the receiver was repainted in December 1985, the peak steady state efficiency increased to about 82%, near design predictions. The receiver average efficiency, although lower than the peak by 5 to 10 percentage points, shows a similar increase after the repainting. Receiver thermal losses (radiation, convection, and conduction), calculated by two different methods, are about 4.5--5.5 MW/sub t/. Receiver life---which includes the effect of receiver start-up, operation time, operation during cloud transients, and panel supports---is an area requiring further evaluation. Within two years from the start of receiver operation, panel tube leaks began to occur. Receiver panel deformations, which continue to occur, will have an adverse effect on the receiver life. 19 refs., 36 figs., 10 tabs.

48397 **(SERI/PR—212-3337) Solid State Photovoltaic Research Branch: Annual report, FY 1987.** (Solar Energy Research Inst., Golden, CO (USA)). Jun 1988. Contract AC02-83CH10093. 252p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88001179/JAW.

This report summarizes the progress of the Solid State Photovoltaic Research Branch of the Solar Energy Research Institute

(SERI) from 1 October 1986 through 30 September 1987. Six technical sections of the report cover these main areas of SERI's in-house photovoltaic research: Semiconductor Crystal Growth, Amorphous Silicon Research, Polycrystalline Thin films, III-V High-efficiency Photovoltaic Cells, Solid State Theory, and Laser Raman and Luminescence Spectroscopy. In each section, the purposes and major accomplishments of this work are explained in the context of the US Department of Energy's National Photovoltaic Program Plan goals. 251 refs., 152 figs., 18 tabs.

48398 **(SERI/STR—211-3335) SERI PV AR and D University Participation Program: Annual subcontract report, FY 1987.** Thornton, J.A.; Schiff, E.A.; Milnes, A.G.; Schlesinger, T.E.; Bedair, S.M.; Taylor, P.C.; Williams, G.A.; Ohlsen, W.D.; Dapkus, P.D.; Bube, R.H.; Gerritsen, H.J.; Crisman, E.E. (Solar Energy Research Inst., Golden, CO (USA); Illinois Univ., Urbana (USA). Coordinated Science Lab.; Syracuse Univ., NY (USA); Carnegie-Mellon Univ., Pittsburgh, PA (USA); North Carolina State Univ., Raleigh (USA). Dept. of Electrical and Computer Engineering; Utah Univ., Salt Lake City (USA). Dept. of Physics; University of Southern California, Los Angeles (USA); Stanford Univ., CA (USA). Dept. of Materials Science; Brown Univ., Providence, RI (USA)). Jun 1988. Contract AC02-83CH10093. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88001182/JAW.

This report describes results of photovoltaic research done under subcontract to the Solar Energy Research Institute as part of the University Participation Program of the PV Advanced Research and Development Project. Participants included groups at the University of Illinois, Syracuse University, Carnegie Mellon University, North Carolina State University, the University of Utah, the University of Southern California, Stanford University, and Brown University. The groups investigated surface reactions during the growth of $CuInSe_2$ films, defects and photocarrier processes in thin-film materials, low-temperature CVD processes for preparing high-efficiency solar cells, ion-beam doping of II-VI compounds during physical vapor deposition, and rapid liquid-phase epitaxy of ternary III-V semiconductors for tandem solar cells. 68 refs., 8 figs.

48399 **(SERI/STR—211-3363) Amorphous silicon photovoltaic devices prepared by chemical and photochemical vapor deposition of higher order silanes: Annual subcontract report, 1 September 1986-31 August 1987.** Delahoy, A.E.; Schade, H.E. (Chronar Corp., Princeton, NJ (USA)). Jun 1988. Contract AC02-83CH10093. 20p. ; 1; GPO Dep. Order Number DE88001189/JAW.

This report describes results of research on preparing high-efficiency photovoltaic devices by photochemical vapor deposition of higher order silanes. The photostability of these devices was compared to that of devices produced by the glow-discharge technique. Hydrogenated amorphous silicon cell efficiencies of at least 7. 5{percent} were obtained using p-i-n structures and aluminum back contacts. Using silver contacts increased the efficiency to about 8{percent}. After 6 minutes of light soaking, there was no significant difference between the photostabilities of these cells and those produced by glow discharge. The efficiencies might be increased further if some remaining problems can be addressed, such as by using a different substrate preparation method or a higher pumping speed at the deposition chamber. 10 refs., 4 figs., 5 tabs.

48400 **(SERI/STR—211-3364) Preparation and properties of high-deposition-rate a-Si:H films and solar cells using disilane: Annual subcontract report, 1 May 1987–30 April 1988.** Bhat, P.K.; Chatham, H.; Madan, A. (Solar Energy Research Inst., Golden, CO (USA); Glasstech Solar, Inc., Wheatridge, CO (USA)). Jun 1988. Contract AC02-83CH10093. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001191/JAW.

This report contains results of the first year of research on producing p-i-n amorphous silicon solar cells with the intrinsic layer deposited from higher order silanes at deposition rates of 1 nm/s or more. The research was divided into three major areas: diagnostic studies of monosilane and disilane RF discharges using optical emission spectroscopy and mass spectrometry to assist in optimizing discharge conditions and gas-phase processes; parametric studies of material properties of 1-layers prepared form disilane as a function of deposition rate and other process parameters; and parametric studies of p-i-n devices with the i-layer prepared from disilane at various deposition rates. The focus during the first year was to fabricate a p-i-n solar cell with 9{percent} AM1.5 efficiency over an area greater than 0.08 cm^2 with the i-layer deposited at 1 nm/s or more. Material properties such as the dark and AM1.5 light conductivities, optical band gap, and conductivity activation energy showed a weak dependence on deposition rate. The performance characteristics of unoptimized p-i-n solar cells with i-layers prepared from disilane were independent of the deposition rate of the i-layer. A p-i-n device was prepared at a rate close to 1 nm/s with an AM1.5 efficiency of 9{percent}. 20 refs, 26 figs, 2 tabs.

48401 **(SERI/STR—211-3365) Thin-film cadmium telluride solar cells: Final subcontract report, 1 May 1985–31 May 1988.** Chu, T.L. (Solar Energy Research Inst., Golden, CO (USA); Southern Methodist Univ., Dallas, TX (USA)). Jun 1988. Contract AC02-83CH10093. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001183/JAW.

This report describes results of research performed to demonstrate thin-film cadmium telluride heterojunction solar cells with a total area greater than 1 cm^2 and efficiencies of 13% or higher. Efforts were directed to (1) the deposition, resistivity control, and characterization of p-CdTe films by combining the vapor of the elements (CVE) and close-spaced sublimation (CSS) techniques; (2) the deposition and characterization of transparent conducting semiconductors; (3) the deposition of p-HgTe as a low-resistance ohmic contact to p-CdTe; (4) the electrical properties of CdS/CdTe heterojunctions; and (5) the preparation and evaluation of heterojunction solar cells. CdS/CdTe solar cells showed the best photovoltaic characteristics, and the best cell had a conversion efficiency of about 10.6%. 20 refs., 30 figs., 1 tab.

48402 **(WES—NORX243) Upper limits of standing crop density for woody species in the prairie provinces.** Peterson, E.B.; Levson, V.M.; Kabzems, R.D. (Canadian Association of Petroleum Production Accounting, Calgary, Alberta; Dome Petroleum Ltd. (Canada)). 1982. 55p. (CE—01702). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Young tree and shrub stands in Alberta, Saskatchewan, and Manitoba were sampled in 1979 to obtain estimates of maximum standing crop density. Aboveground standing crop values double the regional averages were found, with upper limit dry weights of 16.9 t/ha for a 3-year-old aspen-alder stand, 18.1 t/ha for a 4-year-old aspen-alder stand, and 29.6 t/ha for a 5-year-old aspen stand. Some young stands achieved standing crop densities comparable to those of fully closed mature stands. Recorded standing crop densities included 2.16 kg/m/sup 3/ for an 8-year-old willow stand, 1.66 kg/m/sup 3/ for an 8-year-old lodgepole pine stand, and 1.19 kg/m/sup 3/ for a 9-year-old alder stand. Equations for predicting foliage dry weight, wood dry weight, and total aboveground dry weight form independent variables of stem diameter, stem height, stand age, and number of stems per hectare yielded results of low reliability. 21 refs., 2 figs., 32 tabs.

48403 **Photovoltaic safety.** Luft, W. New York, NY; American Institute of Physics (1988). 261p. American Institute of Physics, 335 E. 45th St., New York, NY 10014. Order Number TI88013773/JAW. Contract AC02-83CH10093.

From Photovoltaics safety conference; Denver, CO, USA (19 Jan 1988).

This report contains papers on photovoltaic safety given at the 1988 AIP Conference. The papers include topics dealing with plant safety, exposure control, toxicology, medical and biological montioring, handling procedures, emergency planning, and environmental considerations.

48404 **Limiting recombination in Si concentrator solar cells.** Sinton, R.A.; Swanson, R.M. (Stanford Electronics Labs., CA (USA)). pp 917-921 of Seventh E.C. photovoltaic solar energy conference. Goetzberger, A.; Palz, W.; Willeke, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1987). (CONF-861021—).

From 7. European photovoltaic solar energy conference; Sevilla, Spain (27 Oct 1986).

Several recent papers have discussed the ultimate limits to the efficiencies of Si concentrator solar cells due to the effects of fundamental bulk Auger recombination. Experimental results from backside point contact concentrator solar cells indicate that this Auger recombination is already impacting efficiencies by reducing the quantum efficiencies at high concentrations of sunlight as well as imposing upper limits to the open circuit voltage. A device is presented which was designed to measure this recombination using open circuit voltage decay and steady state illuminated measurements. The Auger coefficient was found to be 1.66 x 10/sup -30/ cm/sup 6//sec in the carrier density range of interest to solar cells, 10/sup 15/ to 2 x 10/sup 17/ carriers/cm/sup 3/. This is 4 times higher than commonly assumed and will impact the design and performance of Si solar cells. 3 figs., 10 refs.

48405 **Passivation techniques for silicon solar cells.** Spitzer, M.B.; Vernon, S.M.; Keavney, C.J. (Spire Corp., Bedford, MA (USA)). pp 1132-1140 of Seventh E.C. photovoltaic solar energy conference. Goetzberger, A.; Palz, W.; Willeke, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1987). (CONF-861021—).

From 7. European photovoltaic solar energy conference; Sevilla, Spain (27 Oct 1986).

The use of heteroepitaxial wide bandgap semiconductor films for passivation of silicon surfaces is presented. The particular films discussed here comprise either GaP or ZnS/sub 1-x/Se/sub x/ , grown by metal organic chemical vapor deposition. Ideally, such films should transmit majority carriers but reflect minority carriers, and should thus be suitable for passivation at surfaces and beneath contacts. Fabrication and characterization of films are discussed. Attainment of a degree of passivation by using GaP is reported. 6 figs. 9 refs., 2 tabs.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 48561, 48730

48406 **(AFME—84-9324) Photovoltaic rural electrification.** Asensio, S. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). Dec 1984. 136p. (In French). NTIS (US Sales Only), PC A07/MF A01; GPO Dep. Order Number DE88754615/JAW.

The operation experience of photovoltaic rural electrification in the french overseas departments and territories (DOM-TOM) is presented and analysed. The technical characteristics are reviewed together with the problems encountered: users behaviour, competitivity with conventional distribution systems, financial incentives or bridles, price rating, etc... Examples are given for Polynesia, Guyana and Martinique.

48407 **(NP—8770366) Possibilities for use of different energy sources in farming. September 1979-March 1982. Final report.** Schulz, H.; Perwanger, A.; Mitterleitner, H. (Landtechnischer Verein in Bayern e.V., Freising (Germany, F.R.); Bayerische Landesanstalt fuer Landtechnik, Freising (Germany, F.R.); Bayerisches Staatsministerium fuer Ernaehrung, Landwirtschaft und Forsten, Muenchen (Germany, F.R.). Referat Landmaschinenwesen und Energiewirtschaft). Dec 1982. 335p. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88770366/ JAW.

This research project is intended to investigate the possible uses of different energy sources in farming. Individual topics of the report are the energy situation in the farming sector, biogas production, building materials for biogas plants, requirement of process energy, storage and consumption of biogas, economic efficiency, methods of investigation, as well as heat generation through solid material composting and heat recovery from the off-air of animal shelters (advantages and disadvantages, demands on heat exchangers for stable off-air, types of heat exchangers, use of heat exchangers, test-stand experiments, cost of material, use of heat pumps). Furthermore the publication is concerned with the utilization of wind power (available wind energy, areas of use, typical wind power plants, practical tests) and the use of solar energy (availability, conversion into electric power, heat recovery, air preheating, time requirement to build simple air collectors, heat storage). (HWJ).

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 48395, 48396, 48561

48408 **(IEA-SHAC-TVI—4) Experimental results from eleven evacuated collector installations: A report of Task VI: The performance of solar heating, cooling, and hot water systems using evacuated collectors.** Duff, W.S. (International Energy Agency, 75 - Paris (France)). Jan 1988. 504p. NTIS (US Sales Only), PC A22. Order Number DE88013777/ JAW.

Four years of thermal performance, operation, maintenance, and longevity for eleven evacuated collector installations in the United States, Canada, Europe, and Australia are reported. Also presented are details on each installations's system, controls, loads, climate, components, and experiments. All installations have used a common set of definitions and reporting format so that different installations's results may be easily and unambiguously compared. Thermal performance results are provided on an instantaneous, daily, monthly, and seasonal basis. Comparisons are made to show what effect differences in collector type, evacuated tube type and size, reflectors, tube spacing, preheating, capacitance, snow cover, season, climate, and end use patterns have on thermal performance, operation, maintenance, durability, and longevity. A concise list of conclusions are presented for evacuated collector and system thermal performance, operation, maintenance, and longevity. 189 refs, 319 figs, 30 tabs.

48409 **(NAL—TM-572, pp 39-44) Use of a space station (Part 2). Extension type testing bench. Consideration on a power generation system with solar collection heat engine.** Nakamura, Yoshihiro. (National Aerospace Lab., Tokyo, Japan). Apr 1987. (In Japanese). National Aerospace Laboratory, 7-44-1, Higashimachi, Jindaiji, Chofu, Tokyo, Japan.

In On the utilization of space station (Part 2).

Composition, performance, advantage, weight and so on of a power generation system with solar collection heat engine on the space station were investigated. The system is composed with solar collection equipment, heat receiving and accumulation equipment, heat transfer equipment, solar heat engine, heat radiation equipment. These equipments are operated in the space for a long term. Therefore, these equipments must be developed considering reliability, durability in addition to efficiency. The advantages of this system in comparison with a solar cell are as follows. An aerodynamic resistance decreases according to the reduction of the solar collection area by the improvement of system efficiency, and the propellant's consumption for keeping of the orbit altitude decreases. Moment of inertia of the solar collection surface decreases, and flight control becomes easier. Light weight heat accumulation equipment can be used and constant power generation or stabilized power supply is achieved. System weight dosen't increase against a large demand of electric power. Degradation by the radioactive rays is improved. Estimated weight of a generation system is as much as a solar cell of 25kW. (2 figs, 3 tabs, 5 refs)

48410 **(NAL—TM-572, pp 45-51) Utilization of space station (Part 2). Extension-type laboratory bench mission. Research on heat engine technology for space use.** Eguchi, Kunihisa. (Nationl Aerospace Lab., Tokyo, Japan). Apr 1987. (In Japanese). National Aerospace Laboratory, 7-44-1, Higashimachi, Jindaiji, Chofu, Tokyo, Japan.

In On the utilization of space station (Part 2).

Recently, the solar heat engine is considered more promising than the solar battery as a means for power generation to supply a

large power above several 10s kW to such facilities as space station. The present report outlines the structure of heat engine power generation systems, expected power to be generated in space in future, performance and current development studies of heat engine cycles (in U.S.) and design and structure of heat engine units. The report also presents the plan for future research by the National Aerospace Laboratory. Light energy collected by a sunlight collector is sent to a solar heat receiver with a light collection efficiency of about 90 percent. About 85 percent of the heat is directly conveyed by a working fluid into a heat cycle engine to drive the engine, which then drives a generator to supply electric power. The Brayton cycle power system and the Stirling engine is considered to have a large potential for such a heat engine. The Laboratory is planning to start element studies in 1987 to provide basic data that are required for the development of a basic design for thermal power generation system scheduled for 1991. (8 figs, 2 tabs, 10 refs)

48411 (NAL-TM—572, pp 52-56) **Utilization of space station (Part 2). Extension type bench mission. Solar thermal thruster.** Shimizu, Morio. (National Aerospace Laboratory. 7-44-1, Jindaiji-Higashimachi, Chofu, Tokyo, Japan). Apr 1987. (In Japanese). National Aerospace Laboratory. 7-44-1, Jindaiji-Higashimachi, Chofu, Tokyo, Japan.

In On the utilization of space station (Part 2).

The report outlines the concept study of solar thermal thrusters and development of trial thrusters resumed by the U.S. Air Force Rocket Propulsion Laboratory. The thruster uses a solar collector for heating to allow a propellant such as H/sub 2/ to spout through a nozzle. With this thruster, the payload capacity will be about 3-fold, 1.5-fold and 2/3-fold compared to the use of a chemical rocket other than liquid acid-liquid water engines, liquid acid-liquid water system and ion engine, respectively. High-speed pumps are not required and the chamber pressure is low (0.15-0.35 MPa), permitting a decreased size and high reliability. AFRPL has developed a thermal propulsion system. The solar collector incorporates a reflector of 6 m in diameter. The target specific impulse is above 800 sec. Rhenium (melting point: 3,45OK) is adopted as material for the hydrogen heater because the hydrogen temperature reaches as high as 2,722K. Its actual specific impulse and thrust are found to be 808 sec. and 3.7N, respectively. (6 figs, 2 tabs, 4 refs)

48412 (NAL-TM—572) **On the utilization of space station (Part 2).** (European Organization for Nuclear Research, Geneva (Switzerland)). Apr 1987. vp. (In Japanese). National Aerospace Laboratory, 7-44-1, Higashimachi, Jinbdaiji, Chofu, Tokyo, Japan.

Papers on solar heat engines and solar thermal power plants have been entered individually.

48413 (PB—88-218565/XAB) **Range water-pumping systems: state-of-the-art-review. Forest Service project report.** McKenzie, D.W. (Forest Service, San Dimas, CA (USA). Equipment Development Center). Feb 1985. 29p. (PR—8522-1201). NTIS, PC A03/MF A01.

Information learned from the investigative effort conducted in the solar-water-pumping systems portion of the Range Water System Improvement project is reviewed. The report covers the development of new windmill designs including fully counterbalanced, spring-counterbalanced and com-operated windmills, hydraulic system to replace pump rods of a conventional windmill, automatic stroke controls for a 3-bladed wind turbine, wind electric ac and dc generators driving ac and dc submersible pumps, windmill-driven air compressor operating an air lift pump, long-life well cyclinder, and performance modeling and testing of windmills. Photovoltaic-powered water-pumping systems discussed include large or oversized solar arrays, series-parallel photovoltaic-panel switching, maximum power controller systems, photovoltaic-powered pumping systems with submersible pump, and solar-thermal pumping systems.

48414 (SAND—87-2921C) **Phase 2 testing of a molten salt central receiver.** Grossman, J.W.; Chavez, J.M.; Riley, E.S.; Boehm, R.F. (Sandia National Labs., Albuquerque, NM (USA); Automated Control Systems, Inc., Albuquerque, NM (USA); Utah Univ., Salt Lake City (USA)). 1988. Contract AC04-76DP00789. 10p. (CONF-880655—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012701/JAW.

From 4. international symposium on research, development and applications of solar thermal technology; Santa Fe, NM, USA (13 Jun 1988).

A 5-MWt molten salt cavity receiver was designed, constructed, and tested in a program funded by the US Department of Energy. The receiver testing was conducted at the Solar Central Receiver Test Facility (CRTF) in Albuquerque, New Mexico. The initial testing, Phase 1, was performed to charcterize the operational capabilities of the receiver. The follow-up testing, Phase 2, was initiated to measure thermal losses and to refine the receiver control algorithm to supplement the data from the Phase 1 testing. The receiver's thermal losses were measured with improved salt mass flow measurements and more accurate temperature measurements to improve the accuracy of the thermal loss data. Additional testing of the receiver control algorithm was undertaken to improve the receiver's control response for recovery from the effects of a cloud transient. In this paper we present the results of the Phase 2 receiver testing and compare them to the Phase 1 test data on receiver thermal loss and cloud transients. 5 ref., 4 figs.

48415 (SAND—87-8005) **A review of the chemical and physical properties of molten alkali nitrate salts and their effect on materials used for solar central receivers.** Bradshaw, R.W.; Carling, R.W. (Sandia National Labs., Livermore, CA (USA)). Apr 1987. Contract AC04-76DR00789. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88010500/JAW.

Sandia National Laboratories, Livermore (SNLL), has been responsible for developing thermal energy collection and storage technologies for solar central receiver (SCR) applications as the lead laboratory designated by the US Department of Energy. The focus of one of these efforts has been the evaluation of the properties of a mixture of sodium nitrate and potassium nitrate as a single-phase working fluid for SCR systems. This report summarizes the results of a comprehensive research program that was established by SNLL to address issues relevant to the use of molten nitrates at temperatures up to 600{degree}C. It is concluded that molten nitrate salt is not only technically feasible as a working fluid for advanced SCR, but is advantageous in a number of ways to alternative fluids. 44 refs., 5 figs., 1 tab.

48416 (SAND—88-8104) **Solar central receiver power plant control system concept.** Mathur, A.K.; Koch, C.G. (Sandia National Labs., Albuquerque, NM (USA); Honeywell, Inc., Roseville, MN (USA). Technology Strategy Center). Jul 1988. Contract AC04-76DP00789. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88014707/JAW.

This report describes the results of a study to determine control system design features and to propose innovative conceptual approaches necessary to increase the productivity of operation and maintenance personnel required to operate a solar thermal central receiver power plant. This study utilized experience gained at the 10 MWe Solar Thermal Central Receiver Pilot Plant located near Barstow, California. The plant, called Solar One, is a cooperative activity between the Department of Energy and the Associates: Southern California Edison, the Los Angeles Department of Water and Power, and the California Energy Commission. 13 figs., 5 tabs.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 48376, 48407, 48425, 48802, 48852, 48863, 48864, 48931

48417 (AFME—84-0295) Contribution to the study of large scale water solar equipment. Soliman, A.T. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1986. 214p. (In French). (AFME—85-09-1052). NTIS (US Sales Only), PC A10/MF A01; GPO Dep. Order Number DE88754617/JAW.

The large scale water solar heating systems (from 174 m2 to 587 m2 collector areas) actual performances often differ from the theoretical performances. Experimental measures (with infrared thermography) were conducted in three solar hot water production systems of large hospitals. The differences between measured and theoretical data are induced by heterogeneities in hydraulic distribution and flow rates in the collectors field. An analytical model was developed for the optimization of the solar collector field hydraulic coupling.

48418 (DOE/CE/15325—T3) ISAAC solar refrigerator: Fourth progress report, January-June 1988. (Energy Concepts Co., Annapolis, MD (USA)). 1988. Contract FG01-87CE15325. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013063/JAW.

This progress report overviews the current status of the ISAAC Solar Refrigerator Program. Contained is a listing of the tasks and an update of efforts aimed at accomplishment of each. (FI)

48419 (EMR/RE—1984) Solar heating catalogue No. 3. Mayo, T. (ed.). (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Renewable Energy Resources Branch). Feb 1984. 165p. (In French). (CE—01756). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The purpose of this catalogue is to identify the individuals, companies, and organizations which make up the solar heating industry in Canada. An introduction describes different kinds of solar heating, how to buy solar equipment, and the kinds of solar hardware available in Canada. A brief description of the product types listed in the catalogue is provided. A directory lists those involved in the solar field, including manufacturers, builders, and designers. A product guide is an inventory of solar systems, components, parts and materials manufactured or marketed in Canada. To be included, products had to be made in Canada with at least 51% of direct costs originating there. Products are grouped into four main sections: systems, such as active space heating and domestic hot water systems; components used in solar heating systems, such as collectors and storage tanks; parts and materials that go into solar systems, such as glazings, insulation, and absorber coatings; and solar design aids, such as computer programs and services.

48420 (ETSU-S—1157-P2) Passive solar design studies for non-domestic buildings. Case studies. (UKAEA Harwell Lab. Energy Technology Div.; Ove Arup and Partners, London (UK)). 1988. 266p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks, LS23 7BQ.

Of the passive solar designs reported, those for a light industrial building, a nurses hostel and a low rise office block were considered to be clearly cost effective. A retrofit study of a secondary school showed that incorporating passive solar measures into refurbishment could be cost effective. Designs for a sports hall and medium rise office block were considered to be only marginally cost effective and those for a hotel bedroom block and DIY superstore were judged not to be cost effective. The maximization of daylight penetration coupled with controls on the lighting systems produced the main energy saving. This orientation, built form, fenestration, window shape, perimeter (and overhead) daylight and atria were primary solar features. Direct gain considered in conjunction with building weight/response factor could contribute to a lesser degree. Trombe walls were shown to be generally uneconomic for this type of building and conservatories contributed to amenity value more than to savings.

48421 (NP—8770294) Energy-conserving greenhouse system equipped with an auxiliary solar heating system. Bredenbeck, H. (Hannover Univ. (Germany, F.R.). Inst. fuer Technik in Gartenbau und Landwirtschaft; Bundesministerium fuer Ernaehrung, Landwirtschaft und Forsten, Bonn (Germany, F.R.)). Aug 1986. 104p. (In German). NTIS (US Sales Only), PC A06. Order Number DE88770294/JAW.

Between 1984 and 1985 measurements were taken on a farm whose greenhouses are supplied with heat by auxiliary solar heating systems. Simulated calculations contributed to clearer statements and results. The paper summarizes the following results: 1) Heat consumption is by two thirds lower. 2) With but 32% of field radiation light transmission is rather poor. 3) The solar system is overdimensioned. 4) It is noisy due to fans installed above ground. 5) It is covering 30% of the annual heat demand. (BWI).

48422 (NRAC/E—SOLWAT2) Analysis of factors affecting thermal performance in solar domestic hot water systems. Wilkinson, R.G. (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). Jul 1982. 38p. (CE—01676). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Three side-by-side tests of closed-loop solar domestic hot-water systems were carried out to determine the differences in thermal performance between one- and two-tank systems, and between systems with internal or external heat exchangers on the collector-loop side of storage. The main conclusions were as follows. The parasitic energy requirements were estimated to average about 1 kWh/d and as such were not of undue concern for these closed-loop systems. Thermal stratification in the single-tank system was very stable when no solar energy was being collected. When the solar-collection system was on, a mixing zone developed between the solar- and auxiliary-heated water. Stand-by losses were marginally reduced in the single-tank system; however, intermixing reduced the size of solar storage. The difference in system efficiency for an external versus internal heat exchangers varied directly with temperature in a similar fashion up to 50/sup 0/C. Above 50/sup 0/, however, the effectiveness of the internal exchanger increased much more quickly with temperature. The performance of the external heat-exchanger system was improved by having the make-up water supplied to the suction side of the water circulation pump. A 300 liter single-tank system was shown to be too small for solar domestic hot-water systems. If the electric element is to be positioned to give a reasonable hot-water capacity, at least 450 liter combined solar plus auxiliary storage is required. 11 figs., 15 tabs.

48423 (NRC/E—PASSIVE5) Solar wall monitoring 1630 MacDonald Street, Vancouver. Logan, H.; Cooper, K. (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). Sep 1982. 50p. (CE—01670). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents the results of montoring carried out on the Logan solar system, a 45 m/sup 2/ mass wall providing space heating and hot water preheating to one 204 m/sup 2/ unit of a three-unit townhouse. This hybrid system operates by forced air convection only. The solar contribution to space heating for the period from August 27, 1980 to April 23, 1981 was about 28 GJ of a total load of about 108 GJ. This is an average solar contribution of 16% based on total load or 35% based on net load after subtracting 27 GJ of internal gains. The space heating auxiliary, therefore, amounted to 53 GJ supplied by the gas furnace, which amounts to 260 MJ/m/sup 2/ floor area. Natural gas consumption was just under 71 GJ of heat equivalent. The solar contribution to domestic water heating for the period of July 31, 1980 to April 23, 1981 was about 1.1 GJ of a total water heating demand of 9.2 GJ, or 12%. Natural gas consumption was 17.3 GJ of heat equivalent. This represents significantly poorer performance than expected. No single factor appears to be the cause, rather a combination of design and

operational factors contributed to the system's poor performances. 3 refs., 19 figs., 12 tabs.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 48395, 48396, 48852

48424 **(AD-A—193726/7/XAB) Solar-energy-absorption efficiency of an ellipsoidal receiver-reactor with specularly reflecting walls. Technical report.** Steinfeld, A.; Fletcher, E.A. (Minnesota Univ., Minneapolis (USA). Dept. of Mechanical Engineering). 5 Apr 1988. 20p. (TR—12). NTIS, PC A03/MF A01.

An ellipsoidal cavity-receiver with specularly reflecting inner walls, in which the reactor component is positioned at one focal point and the aperture at the other, may be useful in solar applications. Most of the incident radiation from a solar concentrator should reach the reactor directly or after one reflection from the cavity walls. Because the source (aperture) and sink (reactor) have finite areas, the ellipsoidal reflector no longer conveys all of the entering radiation into the reactor; some radiation entering the cavity does not reach the target after one reflection and is eventually absorbed by the cavity walls after multiple reflections or escapes through the aperture. The author examined the conditions for which this radiation loss becomes significant and estimated the effects on the energy-collection efficiency of the system.

48425 **(IEA—8012664) Detailed modeling of evacuated collector systems: A report of Task 6: The performance of solar heating, cooling, and hot water systems using evacuated collectors.** Gemmell, W.L.; Chandrashekar, M.; Vanoll, K.H. (Waterloo Univ., Ontario (Canada); IST Energietechnik G.m.b.H. (Germany, F.R.)). Aug 1987. 135p. NTIS (US Sales Only), PC A07. Order Number DE88012664/JAW.

This report describes several numerical models developed for the detailed simulation of solar energy systems by several member countries of the International Energy Agency (IEA) Task VI, namely Australia, Canada, the Netherlands, the USA and West Germany. The intended use for these models varies depending on topics of interest to the individual members and this is reflected in the capabilities of each model. Some of the models are restricted to simulating particular systems of subsystems whereas others are more general in their application. Between them, they cover a wide range of possible solar applications, namely; space heating/cooling, domestic hot water (DHW), industrial process heating (IPH) and district heating systems. The purposes of this report are documentation of these varies models and validation of the models against measured results. 29 refs., 56 figs., 21 tabs.

48426 **(NRC/E—COLL15) Wind loads on solar collectors.** Irwin, P.A.; Gamble, S.L. (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). Jul 1982. 85p. (CE—01675). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study was carried out to obtain data on the effects of wind on solar collector panels. A 1:50 scale model was constructed to cover a range of configurations on flat and pitched roofs. It was instrumented with strain gauges in order to measure the mean and gust wind forces and moments on individual panels of a solar collector array. The model was tested in a 1:300 scale turbulent boundary layer in 15/sup 0/ intervals through the full 360/sup 0/ range of wind directions. The forces and moments have been expressed as coefficients based on the wind pressure at the height of the panel centre and, as such, can be readily combined with the climatic information in the National Building code to calculate wind forces on collector installations in the different regions of Canada. Of the effects investigated, the most important, in the case of flat roofs, were those of the accelerated wind flow over the roof edge and shielding by multiple rows of collectors. For pitched roofs, the major causes of wind loading were the production of vortices at the ends of the roof apex and collectors mounted with back edges above the roof peak, or mounted with a gap underneath the bottom edge. 2 refs., 27 figs., 28 tabs.

48427 **(PB—88-219498/XAB) Corrosion and scale formation due to heat-transfer media used in solar-energy systems.** Wennerholm, H. (Statens Provningsanstalt, Boraes (Sweden)). 1988. 48p. (In Swedish). (SP-RAPP—1988:06). NTIS, PC E03/MF A01.

The general properties of ethylene glycol, propylene glycol, and calcium chloride solutions, as well as corrosion conditions and the scale-deposition process in parts of the solar collector system in contact with liquid are discussed. In closed-systems, scale formation occurs very rapidly. It is largely completed after two days in a sealed laboratory circuit irrespective of the original hardness of the water. Indexes according to Langelier, Ryznar, and Palin at times give conflicting information concerning the corrosiveness of the heat-transfer media. They may give an idea of the tendency for scale information.

48428 **(PB—88-220199/XAB) Five years of outdoor exposure of flat-plate solar collectors: measurements and evaluation of the influence on the thermal performance.** Bergquist, P. (Statens Provningsanstalt, Boraes (Sweden)). 1988. 55p. (In Swedish). (SP-RAPP—1988:08). NTIS, PC E04/MF A01.

National Testing Institute of Sweden (NTI), evaluated most of the flat plate solar collectors available on the Swedish market, with regard to thermal efficiency, durability, and reliability. After completion of laboratory tests, these collectors were mounted outdoors on a roof at NTI, facing south, tilted 45 degrees and without cooling. The test site is located at latitude 57 degrees north. After about 5 years of accelerated ageing under stagnation conditions, some of these have now been reevaluated, with respect to thermal efficiency and a supplementary visual examination. All collectors show changes in their thermal performance. In most cases the authors can observe small or modest changes, but surprisingly not always as a degeneration of the performance. Calculations show no major decrease in the yearly performance. Only two of them show a decrease in efficieny over the operating range of 5 percent or more, but at the same time these collectors cannot be regarded as representative in their design for a solar collector of today.

1420 Heat Storage

REFER ALSO TO CITATION(S) 48407

48429 **(TU/ME—041981) Design and evaluation of central solar heating plants with seasonal storage (storage systems). Final report.** Hooper, F.C.; McClenahan, J.D. (Toronto Univ., Ontario (Canada). Dept. of Mechanical Engineering). Apr 1981. 46p. (CE—01686). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This document examines energy storage factors having applications in the design and evaluation of central solar heating plants with seasonal storage. A brief summary of seasonal energy storage technologies is provided. Emphasis in this paper is placed on site-related characteristics of large, heated water storage tanks, the form of storage which has frequently been identified as the most appropriate among presently available choices for large scale systems. A flexible computer program for the numerical thermal analysis of cylindrical tanks (NTACT-1) is presented including a description of its code structure and the numerical solution techniques. This program is used for determining heat loss factors of buried cylindrical tanks for use in a simplified lumped parameter heat loss model. This lumped parameter model can be merged with existing solar system simulation codes. This will raise the level of confidence above that previously possible in performing simplified engineering design analysis for seasonal storage systems utilizing large, partially or fully in-ground tanks. 1 ref., 7 figs., 1 tab.

48430 (TU/ME—31071982) User manual for a simplified heat loss program based on the extended NTACT model. Final report. Hooper, F.C.; McClenahan, J.D. (Toronto Univ., Ontario (Canada). Dept. of Mechanical Engineering). 31 Jul 1982. 17p. (CE—01710). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

NTACT (Numerical Thermal Analysis for Cylindrical Tanks) is a two-dimensional, explicit form, transient heat transfer computer program written in PL/1, designed to calculate heat losses to the soil from cylindrical thermal storage tanks. Programs of this type (i.e. finite difference in space and time), to be reasonably accurate, require a relatively large amount of computation time as well as memory space. This puts the analysis beyond the range of many architectural and engineering groups who might otherwise participate in the design of such facilities. This document describes a greatly simplified heat loss procedure (SIMLOS) that utilizes tabulated lumped heat loss parameter based on detailed NTACT computations. Tables of values for use within this lumped parameter mode are presented for a wide range of configurations of below ground thermal storage tanks. This simplified model appears to offer excellent accuracy in seasonal storage applications, in which a repeating sinusoidal storage temperature cycle is closely approached. 3 figs., 4 tabs.

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

REFER ALSO TO CITATION(S) 48439

48431 (DOE/ID/12525—1-Pt.1) Three dimensional gravity modeling techniques with application to the Ennis Geothermal Area: Final report: Part 1. Semmens, D. (Montana Coll. of Mineral Science and Technology, Butte (USA)). Dec 1987. Contract FG07-84ID12525. 183p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88014952/JAW.

3-D gravity modeling was done in the area of the Ennis hot spring in an attempt to determine controlling structure of the Ennis hot spring. The modeling was done in a two-step process where: 1) The topography was modeled by modeling the valley fill from the highest elevation in the modeling area to some elevation below the lowest station elevation using Talwani and Ewing's (1960) method of modeling with vertically-stacked, horizontal, n-sided polygons. Once the gravity contributions of the valley fill included in this "topographic model" are calculated, they were removed from the original gravity data; 2) The remaining valley fill was modeled using blocks where the 3-D algorithm for modeling with blocks results from integrating the gravity formula in the X and Z directions and approximating the integration in the Y-direction using a quadrature formula. Finally, an inverse 3-D gravity modeling program was written to automatically adjust the bedrock topography output from this two-step modeling process. The gravity data calculated from the adjusted bedrock topography, output from the inverse modeling program, should match the observed gravity data within the error of the survey. 43 refs., 40 figs., 9 tabs.

48432 (DOE/ID/12525—1-Pt.2) A controlled source audiomagnetotelluric investigation of the Ennis Hot Springs Geothermal Area, Ennis, Montana: Final report: Part 2. Emilsson, G.R. (Montana Coll. of Mineral Science and Technology, Butte (USA). Dept. of Physics and Geophysical Engineering). Jun 1988. Contract FG07-84ID12525. 97p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88014961/JAW.

A controlled-source audiomagnetotelluric survey (CSAMT) at the Ennis Hot Springs geothermal area revealed a low resistivity anomaly (3 ohm-m to 10 ohm-m) in the vicinity of the hot springs. The hot springs issue from the base of a gravel terrace on the west side of the Madison Valley. Low apparent resistivities extend to the west under the gravel terrace as well as to the north in an elongated "plume". To the southwest the apparent resistivity increases rapidly due to an uplift in the valley basement. One-dimensional inverse modeling in the center of the valley indicates a buried conductive layer probably due to a thick layer of clay-bearing sediments since a nearby test well does not show elevated temperatures. Near the hot springs, one-dimensional inverse modeling did not prove useful, partly because of the two and three-dimensional nature of the structure. Two-dimensional forward modeling near the hot springs provides a more quantitative delineation of the low resistivity zone and of the faulted basement uplifts to the west and south. Details of the structure beneath the conductive zone near the hot springs are difficult to resolve and most of the model control in this region is provided by well logs and seismic data. A technique for correcting data collected in the region close to the transmitter where the plane wave assumption is not valid has derived and has been applied to the low frequency data. 29 refs., 35 figs., 1 tab.

48433 (ETSU-G—131F) Geothermal energy in the UK. Review of the British Geological Survey's programme 1984-1987. (UKAEA Harwell Lab. Energy Technology Div.; British Geological Survey, Keyworth). 1988. 241p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This review gives details of borehole drilling and heat flow measurements for a number of potential geothermal sites in the UK. The data confirms the Cumbrian and Weardale granites as the principal anomalies with maximum values of over 120 and nearly 100 mWm/sup -2/ respectively against a mean background value of about 55mWm/sup -2/. The Permo-Triassic sandstones are the principal potential sources of low enthalpy geothermal energy. Sherwood sandstone is a permeable aquifer in south Humberside with a transmissivity of 60 Dm and containing brine at about 50/sup 0/C. Areas favourable for the development of hot dry rock resources are south west England and the north Pennines. The temperature at a depth of 7km within the Weardale Granite is estimated to exceed 220/sup 0/C. Stress-field measurements give a maximum horizontal stress direction of NW to SE with possible local variations. Water-rock reaction investigations are also reported.

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 48433, 48439, 48445

48434 (CRIE-U—86040) Present status of geologic dating methods. Sone, Kenji. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Jun 1987. 40p. (In Japanese). NTIS (US Sales Only), PC A03. Order Number DE88753442/JAW.

Various geologic dating methods are used in the assessment of the fault activity at the location selecting for a nuclear plant, or for the study of thermal hysteresis of the rocks for geothermal development. There are many dating methods, and they have their respective objects and ranges of dating, among which an optimal method must be selected. Study on the literatures on the dating methods was conducted. 1. Principles, objects, dating ragnes of respective dating method. 2. Applicable method to each of geological material. 3. Example of application of dating method. In conducting the dating method, it is necessary to carefully examine the geologic conditions and combine the applicable methods in order to reach accurate values. A dating method which can potentially provide absolute dates on sediments older than 50,000 years should be researched. (10 figs, 6 tabs, 150 refs)

48435 Geothermal energy symposium. New York, NY; American Society of Mechanical Engineers (1988). 415p. (CONF-880104—). American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017.

From 11. annual energy-sources technology conference and exhibition; New Orleans, LA, USA (10 Jan 1988).

This book contains 54 papers. Some of the titles are: A new concept of HDR reservoir systems in sedimentary rocks; Geochemical reactor for advanced geothermal energy utilization; Geothermal versus other options; A new approach to the analysis of bottom hole assembly performance; Research in lost circulation control for geothermal wells; Geothermal exploration and drilling; and The role of the investment banker in the geothermal industry.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 48434, 48435

48436 **(ETSU-G—137-P3) Heat flow and temperature prediction in the vicinity of the Carnmenellis Pluton.** (UKAEA Harwell Lab. Energy Technology Div.). 1988. 65p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This report details the heat flow and temperature prediction in the vicinity of the Carnmenellis Pluton as part of the Phase 2B programme of the Camborne School of Mines Hot Dry Rock Geothermal Energy Project at Rosemanowes Quarry. Three deep holes were drilled at Rosemanowes quarry (Wells RH11, RH12 and RH15) and equilibrium temperature logs from two of these holes (wells RH11 and RH12) have been used in conjunction with conductivity and heat production measurements to calculate a heat flow value for the Rosemanowes site, after applying the full palaeoclimate correction to the temperature data. A three-dimensional finite element model of the Carnmenellis granite has been produced to describe the distribution of all heat flows observed on the granite hitherto and the same model has been used in the prediction of temperatures at depth.

48437 **(ETSU-G—137-P4) Camborne geothermal energy project geochemistry results (1984-1986).** (UKAEA Harwell Lab. Energy Technology Div.). 1988. 117p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Regular injection and production water samples were collected from wells RH12 and RH15 from the Phase 2B reservoir. These were collected prior to viscous gel stimulation and during subsequent circulation. Samples were analysed for a suite of major, minor and trace constituents and the results interpreted in terms of water-rock interactions in the reservoir. Results from the pre-viscous stimulation Phase 2B system were almost identical to those observed in the Phase 2A reservoir, despite the slightly higher temperature and lower reservoir residence time connection of the former. These were generally the irreversible formation of clays, chlorites and carbonates from primary feldspars and micas in the host rock. These reactions also appear to be continuations of those present in the natural circulation system prior to development of either reservoir.

48438 **(ETSU-G—137-P6) Camborne geothermal energy project crosshole seismic results (1984-1986).** (UKAEA Harwell Lab. Energy Technology Div.). 1988. 161p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Seismic techniques provide the only method of determining the position and shape of the stimulated region created by hydraulic injections at the Camborne School of Mines (CSM), hot dry rock (HDR) geothermal energy research programme. The mapping of microseismic events caused by hydraulic injections has been the main seismic technique employed to image the reservoir. However, it is not known whether the microseismic clusters define the reservoir position and shape or if the reservoir grows aseismically and the seismicity is not associated with any appreciable increase in permeability. Cross-hole seismic surveys have been used to independently determine the reservoir position and shape and to try and quantify the effect of the Phase 2A circulation of water and Phase 2B viscous stimulation on the reservoir. The cross-hole surveys show that the reservoir has a marked effect on the frequency, amplitude and velocity of propagation of seismic waves.

48439 **(EUR—11152) Sant Cugat geothermal project.** Aspiroz, J.M. (Commission of the European Communities, Luxembourg. Directorate General Telecommunications, Information Industries and Innovation). 1987. 122p. NTIS (US Sales Only), PC A06. Order Number DE88013986/JAW.

The aim of the project is to confirm the existence of a geothermal resource situated at a depth of between 400 and 1000 m in the highly fractured granitic fault zone of the eastern border of the Valles Graben at Sant Cugat, Catalonia, and to construct a preliminary model of the behavior of the reservoir. 44 figs., 4 tabs.

1505 Economic And Financial Aspects

REFER ALSO TO CITATION(S) 48435, 48439

1506 Environmental Aspects And Waste Disposal

48440 **(ETSU-G—148) Infrastructure study of Weardale and Cumbria.** (UKAEA Harwell Lab. Energy Technology Div.; RTZ Consultants Ltd., Bristol (UK)). 1988. vp. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The programme of work outlined covered consultations with relevant planning authorities in each county (Weardale, Tyne Tees, Durham and Cumbria), discussions with transport, water and electricity authorities plus British Rail and British Coal, and evaluation of domestic, commercial and industrial heat loads and infrastructure requirements of long distance heat transmission mains. When discussions were held with the relevant authorities it was explained to them that the purpose of the study was a first step towards the investigation of the feasibility of a HDR project to produce a 25 MW electrical power station or as a source for district heating or a combined heat and power scheme.

1508 Geothermal Power Plants

48441 **(EGG-M—88133) DOE/EPRI hybrid power system.** Stiger, S.G.; Taylor, K.J.; Hughes, E.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 4p. (CONF-880477—8). NTIS, PC A02. Order Number DE88015109/JAW.

From 6. DOE geothermal program review; San Francisco, CA, USA (19 Apr 1988).

One of the primary objectives of the DOE Geopressured Geothermal Program is to improve methods for optimum energy extraction from geopressured reservoirs. Hybrid power systems which take advantage of the chemical and thermal energy content of geopressured fluids could improve conversion efficiency by 15 to 20% over the same amount of fuel and geothermal fluid processed separately. In a joint DOE/EPRI effort, equipment from the Direct Contact heat Exchange test facility at East Mesa is being modified for use in a unique geopressured hybrid power plant located at the Pleasant Bayou wellsite in Brazoria County, TX. Natural gas separated at the wellhead will fuel a gas turbine, and exhaust heat from the engine will be used with the geothermal brine to vaporize isobutane in a binary power cycle. The hybrid power system is designed for 10,000 bbl/day brine flow, with estimated power production of 980 kW (net). In addition to evaluating the enhanced performance resulting from the combined power generation cycles, operation of the hybrid unit will provide a demonstration of fuel flexibility in an individual plant. This approach would allow a resource developer to reduce costs and risks by optimizing production for various economic climates and would improve the mix in a utility's generating system. 5 refs., 2 figs.

48442 **(ETSU-G—141) Hot dry rock tri-lateral wet vapour cycle study. Abridged final report.** (UKAEA Harwell Lab. Energy Technology Div.; KSES Ltd., Slough (UK)). 1988. vp. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The possibility of producing power from geothermal hot dry rocks by pumping water under pressure through a deep drilled doublet of wells is the subject of research and investigation work carried out currently within the U.K. at Rosemanowes Quarry and at Los Alamos in the U.S.A. Based on the assumption that the cost and technical problems of completing and operating a doublet of wells can be resolved, then a source of hot water at temperatures in excess of 200/sup 0/C and flowing at approximately 75kg/s can be made available for space heating and power generating. Within the U.K. the most attractive utilisation is in generating electrical power and it has been shown that the most cost effective power generation plant for a resource in the 200/sup 0/C plus temperature range is the tri-lateral wet vapour cycle. Performance and cost data are presented.

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 48435

48443 (DOE/ID/12529—T1) [Stanford Geothermal Program]: Quarterly technical progress reports, January-March and April-June 1988. Horne, R.N. (Stanford Univ., CA (USA). Stanford Geothermal Program). 1988. Contract AS07-84ID12529. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014966/JAW.

This is a quarterly technical progress report of the Stanford Geothermal Program. The report contains information about the status of: Well test analysis in complex reservoirs; Analysis of fractured reservoirs; Relative permeability of fractures; Block size distribution estimation; Well testing in composite reservoirs; High velocity flow of gases and vapor through porous media; and Determination of fracture aperture by a multi-tracer approach. 13 refs., 8 figs. (DT)

48444 (DOE/SF/16482—T1) Heat extraction in fractured hydrothermal reservoirs: Final report. Kruger, P. (Stanford Univ., CA (USA). Dept. of Civil Engineering). 30 Jun 1988. Contract AC03-86SF16482. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88016259/JAW.

The main objective of the Heat Extraction Project has been the development of means to estimate the thermal behavior of geothermal fluids from fractured hydrothermal resources based on production of mixed reservoir fluids from heat sweep by reinjected brine and resource fluid cooled by drawdown and infiltrating waters. Several reports and publications, listed in the concluding section of this report, resulted from the application of the SGP heat sweep model to achieve this objective. The Heat Extraction Project made major advances in the development of the 1-D Heat Sweep Model and its application in geothermal fields in several countries. Heat sweep joint studies are underway for reinjection evaluation at the Los Azufres, Los Humeros, and La Primavera fields in Mexico, for the 500 t/h reinjection test for the redevelopment program at Wairakei, New Zealand, for two hot water supply recirculation systems to be developed in the USSR, and for the phase 2 test at the Hot Dry Rock project at Fenton Hill, New Mexico. Advances were also made in the cooperative studies with CFE at Los Azufres on the evaluation of the effects of early operation of small wellhead generators on the reservoirs of potentially large geothermal fields. 9 refs., 5 figs.

48445 (EGG-M—88141) Research to understand and predict geopressured reservoir characteristics with confidence. Stiger, S.G.; Prestwich, S.M. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 5p. (CONF-880477—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015104/JAW.

From 6. DOE geothermal program review; San Francisco, CA, USA (19 Apr 1988).

The Department of Energy's Geopressured Geothermal Program has sponsored a series of geoscience studies to resolve key uncertainties in the performance of geopressured reservoirs. The priority areas for research include improving the ability to predict reservoir size and flow capabilities, understanding the role of oil and gas in reservoir depletion and evaluating mechanisms for reservoir pressure maintenance. Long-term production from the Gladys McCall well has provided the basis for most of the current research efforts. The well was shut-in on October 29, 1987, for pressure recovery after producing over 27 million barrels of brine with associated gas. Geologic investigations are evaluating various mechanisms for pressure maintenance in this reservoir, including recharge from adjacent reservoirs or along growth faults, shale dewatering, and laterally overlapping and connected sandstone layers. Compaction studies using shale and sandstone core samples have provided data on the relationship between rock compression and reservoir pressure decline and the correlation to changes in porosity and permeability. The studies support the use of a porosity-coupled reservoir simulation model which has provided an excellent match to the well's production history. 10 refs., 3 figs.

48446 (ETSU-G—137-P13) Camborne geothermal energy project. Viscous stimulation of hot dry rock reservoir. (UKAEA Harwell Lab. Energy Technology Div.). 1988. 135p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This reports details the background to and the design of the stimulation treatment for connecting two of the trial boreholes at the hot dry rock project in Cornwall. Modelling was performed to aid decision making. Fracturing was performed by injecting 5500 tons of fluid at an average flow rate of 200 l/sec. Subsequent logging indicated considerable axial fracturing. It is concluded that the more direct lower resistance connection between the two boreholes was probably achieved by the stimulation of natural joints and not by the creation of new artificial fractures.

48447 (SAND—88-1303) High temperature geophysical instrumentation. Hardee, H.C. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1988. Contract AC04-76DP00789. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015150/JAW.

The instrumentation development program was to proceed in parallel with scientific research and was driven by the needs of researchers. The development of these instruments has therefore included numerous geophysical field tests, many of which have resulted in the publication of scientific articles. This paper is a brief summary of some of the major geophysical instruments that have been developed and tested under the High Temperature Geophysics Program. These instruments are briefly described and references are given for further detailed information and for scientific papers that have resulted from the use of these instruments. 9 refs., 14 figs.

1510 Direct Energy Utilization

48448 (ETSU-G—126/E) Report on an investigation to assess the potential and cost effectiveness of geothermal heating for Lindsey Comprehensive School, Cleethorpes. (UKAEA Harwell Lab. Energy Technology Div.; Hoare Lea and Partners, Bristol (UK)). Jun 1984. 23p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This report has assessed the potential and cost effectiveness of utilising geothermal energy from a proposed well close to the Lindsey Comprehensive School. It concludes that it only appears to be cost effective if a suitable aquifer is found in the Permian Strata, yielding water at approximately 60/sup 0/C. The water from the aquifer should then be used directly from the secondary side of the well head heat exchanger in a bivalent mode of operation with the existing fossil fuel source. The degree of modification to the school heating systems will determine how effective the utilisation can be and further investigation is warranted to ascertain how this can be implemented. Any further investigation should also consider downhole pumping costs in relation to the temperature stretch adopted across the system as this may involve further capital expenditure on the proposed heating sytem modifications.

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 48443

16 TIDAL AND WAVE POWER

1608 Wave Energy Converters

48449 (ETSU-WV—1512-P7) Design considerations of submarine power links. Wallace, A.R.S. (UKAEA Harwell Lab. Energy Technology Div.; Edinburgh Univ. (UK). School of Engineering Science). May 1976. 87p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The high installation and repair costs incurred in the transfer of electrical power across an expanse of water suggest careful consideration should be given to the choice of the route followed by a

submarine cable. This dissertation is intended to suggest a design procedure for choosing the best of several possible routes suggested by initial consultation of hydrographic charts. The Western Isles of Scotland are considered in this dissertation. Varied bottom conditions and currents present a high degree of flexibility in the choice of routes. This dissertation attempts to relate the required and permissible current flow to the submarine environment. The tendency of the cable to sink irretrievably into sediment is analysed. The hydrodynamic forces on the cable are related to the cable dimensions and seabed conditions. The tendency of the cable to move under the action of these forces is also analysed. It has been established that the sections of crossings which require protection are the shore ends. Larger cables may be used at the shore ends in order to increase the safety of the link.

48450 **(ETSU-WV—1512-Pt.2) Second year interim report on Edinburgh Wave Power Project 'Study of mechanisms for extracting power from sea waves'.** Jeffrey, D.C.; Richmond, D.J.E.; Salter, S.H.; Taylor, J.R.M. (UKAEA Harwell Lab. Energy Technology Div.; Edinburgh Univ. (UK)). Sep 1976. 167p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This report is concerned mainly with the measurement of backbone forces on a string of floating duck converters. The results from experiments on single models in a narrow wave tank are presented showing surge and leave forces on cylinders and ducks of various dimensions.

48451 **(ETSU-WV—1512-Pt.5) Updated report on the Edinburgh-Laing wave energy device (The Duck).** (UKAEA Harwell Lab. Energy Technology Div.; Edinburgh Univ. (UK); Laing (John) Ltd., London (UK)). Oct 1981. 320p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The Duck wave energy converter, its moorings and power conversion, collection and transmission systems are described in this report. The state of development of the project is reported and engineering aspects are appraised. Reliability, inspection and maintenance are considered. The report concludes with some estimates of performance, productivity and cost.

48452 **(ETSU-WV—1518-Pt.5) Wave energy programme feasibility study on a submerged resonant duct. Third report.** (UKAEA Harwell Lab. Energy Technology Div.; Vickers Ltd., Eastleigh (UK). Design and Projects Div.). Jan 1979. 46p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The tank tests on the Vickers device have shown that the device is capable of extracting 90% of the available wave energy in regular waves on a wave front equal to the duct diameter. This has been measured after flow rectification at a depth corresponding to approximately 12m. at full scale. It is concluded that this, coupled with the device's sub surface operation, omni-directional performance and built in rectification, justifies further investigation of the system. Although the forecast cost of the device, as presently envisaged, is high when compared with other methods of producing electrical power, especially when the means of holding the device in place that have been considered so far are fully costed, it is believed that substantial cost savings can be effected by decreasing the structure size and increasing the efficiency.

48453 **(ETSU-WV—1523-Pt.1) Comparative fatigue tests on 3 core 22 kV A.C. Submarine cable for floating wave energy convertors. Final report.** McConnell, J.; Prewett, M.D. (UKAEA Harwell Lab. Energy Technology Div.). Jul 1983. 85p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The transmission of electrical energy from a series of floating Wave Energy Convertors (WEC) to a shore-based transmitting station by means of submarine power cables is investigated. A study of the problems likely to be encountered in the generation and transmission of power from WEC quickly concluded that further research was necessary into the development of flexible power cables capable of transmitting up to 10 MW of power with a high degree of reliability. This research was required because this was a novel application of existing power cable technology the nearest analogy to which was the flexible cables used to power walking drag line excavators used in open cast mining operations throughout the world. Cables of this type were known to survive considerable maltreatment and were expected to operated in extremes of temperature (+- 30/sup 0/C) but were subjected to comparatively few flexing cycles throughout their working life.

48454 **(ETSU-WV—1527-Pt.2) Simulation of the Wavepower raft.** (UKAEA Harwell Lab. Energy Technology Div.; International Research and Development Co. Ltd., Newcastle upon Tyne (UK)). Oct 1979. 13p. (IRD—TM-79-372). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The principles upon which the simulation of the single hinge Wavepower raft is based are described. The main parameters controlling the motion of the raft, and operation of the vane pump and reservoir, are derived. The operation of the Kaplan turbine is described in a separate report.

48455 **(ETSU-WV—1532-Pt.1) Dynamic response of flexible structures among waves. Final report.** Sepahy, D.; Copplestone, R.J.; Sims, N. (UKAEA Harwell Lab. Energy Technology Div.; Lloyd's Register of Shipping, London (UK). Hull Structures Dept.). Aug 1980. 154p. (LRS-HS—80/63). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This report describes the computer numerical capabilities developed to obtain the linear dynamic response of flexible wave energy devices to irregular sea waves, using finite element techniques for structural modelling and three-dimensional diffraction theory for fluid modelling. Two established computer programs are used for this purpose:-1. NMI diffraction program for multiple bodies, for the fluid model. 2. NASTRAN for the structural model and dynamic response of the system. These programs were modified to suit the required analysis, particularly in processing of input/output data and the provision of graphic facilities. A communication program was developed to transfer data from the NMI diffraction program to NASTRAN. The computer capabilities are demonstrated by giving modelling technique, input data and results for two different types of device, i.e. for a string of ducks, and for rafts.

48456 **(ETSU-WV—1537-Pt.1a) Waves recorded off South Uist in the Hebrides. Data for March 1976 to February 1978 at position 57/sup 0/ 18'N, 07/sup 0/ 38'W. Summary analysis and interpretation report.** Fortnum, B.C.H. (Institute of Oceanographic Sciences, Godalming (UK)). (UKAEA Harwell Lab. Energy Technology Div.; Institute of Oceanographic Sciences, Godalming (UK)). 1981. 83p. (IOS-Rep—115). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Wave measurements have been made off the island of South Uist using Waverider buoys. Data collected on wave heights and periods, showing daily, monthly and seasonal variations of different parameters, are extensively presented in the form of graphs and histograms. Data on monthly wind speed variations in the area over the same period are also presented.

48457 **(ETSU-WV—1541-Pt.1) Guidance notes for the structural design of wave energy devices.** Robinson, D.W. (UKAEA Harwell Lab. Energy Technology Div.). Mar 1979. 52p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This document aims to give some guidance on all the main considerations relating to the structural design of floating wave energy devices and their moorings, including construction, maintenance and inspection where this affects design. The major part of the notes has four objectives; (i) to suggest procedures to be used for as many aspects of the structural design process as possible; (ii) to highlight areas where there is a lack of knowledge or data; (iii) to achieve standardization in problem approach; (iv) to identify what supporting documents are necessary for the assessment of a design. Costing, details of construction techniques, power output performance and generation plant design are not dealt with.

48458 **(ETSU-WV—1546-Pt.1) End of contract report on the IOS Scilly Isles/Kinnairds Head wave measuring programmes.** (UKAEA Harwell Lab. Energy Technology Div.; Institute of Oceanographic Sciences, Wormley (UK)). Jan 1983. 8p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Buoys equipped to measure wave power and to transmit the data to a shore receiving station have been deployed off the coast of the Isles of Scilly and off Kinnaird's Head in eastern Scotland. This report summarizes the operational background and experience of the exercise and presents monthly results over a two year period. The variability of data return figures, expressed as a percentage of possible returns, reflects the difficulties encountered in recording a signal continuously over long periods at both sites but particularly at Kinnaird's Head. Those power figures which have emerged for Kinnaird's Head are low and suggest that this geographical area is of marginal interest. The Isles of Scilly figures are much higher.

48459 **(ETSU-WV—1551-Pt.4) Lancaster Flexible Bag. Longitudinal strength investigation for Wavepower Ltd.** (UKAEA Harwell Lab. Energy Technology Div.; Wavepower Ltd., Southampton (UK)). Sep 1979. 40p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The results of longitudinal strength calculations carried out on behalf of Wavepower Limited by Keel Marine Ltd. (Marine Consultants) during September 1979 are detailed. A static approach to this problem was adopted, the structure being assumed to be poised in static equilibrium on the wave. Ten cases were investigated, with and without the smith correction. The greatest static bending moment was found to be 148678 tonne metres for case No. 10, 10 M Wave Crest, structure floating on its side.

48460 **(ETSU-WV—1551-Pt.5) Report on the feasibility of construction and development of a flexible structure for the Lansster wave power project.** (UKAEA Harwell Lab. Energy Technology Div.; Wavepower Ltd., Southampton (UK)). Sep 1979. 24p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The report presented deals with the feasibility of manufacturing the 'Lancaster Loop' based on current technology and production facilities, and endeavours to assess the developments which can be anticipated and in some cases will be required in order to improve the integrity of the flexible structure and to facilitate its production. Characteristics leading to premature failure such as delamination and flex cracking have been thoroughly investigated and methods of improving life resulting from these investigations have been incorporated and proven on hovercraft. Methods of fabrication including bonding and mechanical joints have required intensive development to achieve the reliability necessary for commercial operation.

48461 **(ETSU-WV—1551-Pt.8) Design and production of a high-pressure, steel Cockerell Wave Energy Raft.** (UKAEA Harwell Lab. Energy Technology Div.; Wavepower Ltd., Southampton (UK)). Nov 1979. 35p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Space frame design drawings included.

Further design effort has led to a High Pressure system Cockerell Raft embodied in a pair of flaps hinged to a space frame main raft. The invoiced (gross) steelweight of each raft is estimated to be 4,700 tonnes and comprises 420 plates and 1,050 stiffeners. At 80 rafts per year the annual throughput for a new raft production facility would be 368,400 tonnes of steel per year, comprising 33,600 plates and 84,000 stiffeners. It is suggested that Hunterston on the Firth of Clyde should be the first place for consideration as the location for the first facility. Rafts would be constructed from blocks in a complex completely covered and protected from adverse climate; brought together on a moving line basis. The blocks would be assembled on a moving line basis separated by type of product into four production lines, again in completely protected environment.

48462 **(ETSU-WV—1551-Pt.10) Report on a preliminary consideration of the design, operation and manufacturing problems of the pump assembly for the proposed Wave Energy Extractor of Wave Power Limited.** (UKAEA Harwell Lab. Energy Technology Div.). [1979]. vp. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks, LS23 7BQ.

During initial discussions it was established that the complete raft is designed to produce an electrical power output of 3 M.W. given waves of sufficient amplitude with a wave period of 6 to 14 seconds. Reliability and robust construction are of prime importance as inspection is to be at five year intervals during an operational life of 25 years with the possibility of an inspection dry docking in mid life. The pump chambers draw sea water from beneath the raft and discharge through a central duct to a centrally placed storage tower 8 m wide x 16 m long against a mean head of 18m. The storage tower extends to a maximum head of 22m at which point overflow will occur if delivery exceeds demand.

48463 **(ETSU-WV—1551-Pt.11) Wave power project.** (UKAEA Harwell Lab. Energy Technology Div.). Oct 1979. 13p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This document describes a Wave Energy device and its construction as envisaged at the moment. The device consists of two tubes each divided into eighteen cells by septa installed below the surface of the sea on a concrete hull. Each tube is formed partly from the concrete hull and partly from a rubberised fabric section clamped along its length. The varying hydrostatic pressure caused by sea waves passing along the tubes, causes air to be compressed and sent via ducts to a turbine where the energy is extracted before returning to the two tubes. A material specification is given; the method of fabrication, transportation and installation is outlined; and estimates of the capital investment and total cost are made.

48464 **(ETSU-WV—1551-Pt.17) Lancaster Flexible Bag. Memorandum on hull costs.** (UKAEA Harwell Lab. Energy Technology Div.). Nov 1979. 2p. (GP—7919). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The proportions and possible construction procedures make the cost of the Lancaster Flexible Bag wave energy device closer to bridge structures than to any other. Consequently, costs for recent prestressed concrete bridge decks have been investigated. From this exercise, an estimated current (October 1979) cost of $100 per ton has been arrived at for the Lancaster Flexible Bag hull. A considerable long term reduction is anticipated if full advantage of mass production is taken and production procedures are optimized.

48465 **(ETSU-WV—1551-Pt.50) Computations of LFB power in South Uist wave climate.** (Department of Energy, London (UK). Energy Efficiency Office; Wavepower Ltd., Southampton (UK)). Sep 1982. 5p. (WP—147). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

A program has been written to provide a preliminary assessment of the power to be realized in practical random seas from wave spectra data and regular wave results for a Lancaster Flexible Bag converter. The averaging method employed was tested with a floating double sided model in a wave tank and was verified to well within the experimental accuracy of 5%. The program also finds the mean annual electric power assuming loss-less turbines and generators within a 10:1 power range and has been used to investigate the optimum orientation of the device.

48466 **(ETSU-WV—1553-Pt.1) Report on feasibility study of the Clam Wave Energy Device.** (UKAEA Harwell Lab. Energy Technology Div.; Lanchester Polytechnic, Coventry (UK); Sea Energy Associates Ltd., Feltham (UK)). Apr 1979. 80p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The main emphasis of the feasibility study has been towards producing an acceptable spine design for the Clam wave energy converter. Concrete and steel designs based on a mathematical

model of the waveloading have been produced. Progress is also reported in the design of a bellows for a low-pressure air power transmission system. A narrow wave tank and scale model have been constructed in order to carry out a test programme on various aspects of the device's construction and performance.

48467 **(ETSU-WV—1555-Pt.16) Latest developments with the triplate wave energy converter.** Altmann, H.; Farley, F.J.M. (UKAEA Harwell Lab. Energy Technology Div.; Royal Military Coll. of Science, Shrivenham (UK)). Aug 1979. 21p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

In this device three vertical plates spaced $\lambda/4$ and $\lambda/2$ respond to the horizontal motion in the waves. The latter two plates have a fixed separation and remain almost stationary as a result of the half-wave resonance between them. The front plate moves to and fro, driving a double acting pump to produced hydraulic power. The device can give a good match to the incoming wave. Theoretical and experimental curves of efficiency vs wave period are presented for various plate depths and spacings. Forces in the system agree with theory for small waves, and have also been measured for large breaking waves. A method of limiting the structural forces in rough seas has been devised. A tentative full scale design is discussed.

48468 **(ETSU-WV—1571-Pt.1) Nature conservation implications of siting wave energy converters off the Moray Firth.** Probert, P.K. (UKAEA Harwell Lab. Energy Technology Div.). Mar 1980. 86p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

A report for Technical Advisory Group 7 (Wave Energy Steering Committee.

The diverse natural environment of the Moray Firth area, which includes features of high nature conservation interest, is described. Since proposals for siting wave energy converters in this area have yet to be defined, it is not at present possible to identify specific implications for nature conservation. However, factors which could have a marked effect include an altered wave regime changing the coastal physiography and biology; the need for large quantities of local aggregate; possible land reclamation; provision of construction and harbour facilities; interaction with the oil industry; and general industrialization and urban growth. The potential impact of such factors is examined.

48469 **(ETSU-WV—1581-P5) Reliability study of wave power devices. Pt.2. Availability assessment of the power generating plant on the N.E.L. oscillating water column.** James, R.E. (Y-ARD Ltd., Glasgow (UK)). (UKAEA Harwell Lab. Energy Technology Div.; Y-ARD Ltd., Glasgow (UK)). 1981. vp. (YM—3552/80). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The failure characteristics and potential corrective maintenance strategies to quantify the availability of the power plant on individual N.E.L. Oscillating Water Column devices and for 40 MW device groups are examined. Comparison is made between the design of the floating and bottom standing device types. It is concluded that frequent corrective maintenance will be required in all seasons to achieve output power levels comparable with land-based power stations. The dominant items, with respect to power loss and maintenance effort, are identified and bases established against which cost effective maintenance support and design change judgements can be made. It is recommended that cost analyses of these aspects be undertaken and that further study of the performance characteristics of the bottom standing device type also be undertaken to determine whether it should be selected in preference to the floating device type.

48470 **(ETSU-WV—1581-P12) Reliability study of six wave power devices.** Turner, G.M.; James, R.E. (Y-ARD Ltd., Glasgow (UK)). (UKAEA Harwell Lab. Energy Technology Div.; Y-ARD Ltd., Glasgow (UK)). 1982. vp. (YR—2814/81). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The reliability of each of six wave power devices nominated by ETSU are analysed and information required for an availability evaluation of a 2GW array of each device is provided. The analyses examine their ability to maintain electrical power output (reliability), their repairability, and limited aspects of safety (of the devices, their plant and to personnel). The major contributions to loss of reliability and areas requiring improvement are identified. Ways of improving the devices are suggested. The analyses information is used to compare approximately the attributes of the devices required for a 2GW array and shows a ranking order of merit for bottom standing and floating devices.

48471 **(ETSU-WV—1581-Pt.4) Reliability study of wave power devices. Phase 2. Collection and treatment of historical failure data and novel feature analysis for the French Flexible Bag.** James, R.E. (UKAEA Harwell Lab. Energy Technology Div.; Y-ARD Ltd., Glasgow (UK)). Nov 1980. 33p. (YM—3471/80). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This memorandum provides failure rate data for both conventional and novel equipment within the design of the French Flexible Bag wave power device. Lack of definition of equipment limited the scope of the data search and necessitated adoption of generic data sources. This plus the need to estimate an environmental factor for data adjustment, has diminished the quality of data. It concludes that the data will, in general, satisfy the present study objectives and that an adequate basis exists for assessment of device reliability.

48472 **(ETSU-WV—1581-Pt.13) Literature review on the feasibility and limitations of reducing equipment failure rates to improve the reliability of wave energy devices.** Gray, J.N.P.; James, R.E. (UKAEA Harwell Lab. Energy Technology Div.; Y-ARD Ltd., Glasgow (UK)). Nov 1982. 52p. (YM—4056). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This note reviews the three categories of failure, i.e. early life, random or chance and wearout which are experienced by an engineering system from the prototype stage through to obsolescence. Reliability growth programmes, as a means of reducing the incidence of failure are introduce and two practical (real life) cases of such programmes are described. In both instances the attainment of high reliability was of paramount importance and the concept of a totally reliable system is shown to be naive on these and other bases. The note concludes with a brief discussion on the reliability growth and maintainability of wave energy devices.

48473 **(ETSU-WV—1603-Pt.2) General program on spine problems. Parametric studies on three different spine configurations. Phase 1, Stage 1. Salter ducks.** Copplestone, R.J.; Sims, N. (UKAEA Harwell Lab. Energy Technology Div.). Feb 1981. 397p. (LRS-HS—81/9). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

NASTRAN-generated plots from the analysis of various duck string lengths are presented. Plots are included for regular 1m amplitude waves. All the statistical plots (i.e. spectral densities and autocorrelations) are for an unidirectional Pierson-Moskowitz spectrum corresponding to Beaufort Number 8. Pots for a 3-duck string at 0/sup 0/, 15/sup 0/, 30 and 45/sup 0/ wave headings and 5-duck strings at 0/sup 0/ and 15/sup 0/ wave headings are presented.

48474 **(ETSU-WV—1612-Pt.2) Review of current methods for analysing the characteristics of mooring systems. Pt. 2. Model tests.** (UKAEA Harwell Lab. Energy Technology Div.). Jul 1980. 18p. (LRS-HS—80/47). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Model tests aspects of a three part review of methods for analysing the characteristics of mooring systems are examined. The need for model tests is discussed and techniques to be used to estimate 1st and 2nd order responses of mooring systems are recommended. Areas where more work is necessary before a total specification of tests is possible are considered.

48475 **(ETSU-WV—1629-Pt.1) Sensitivity of wave energy devices to errors in wave spectrum formulation. Vol. 1.** Copplestone, R.J. (UKAEA Harwell Lab. Energy Technology Div.). Aug 1981. 175p. (LRS-HS—81/51). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The behaviour of wave energy devices in a variety of sea states and the effect of errors in the spectra defining these states have been investigated. The wave energy device under consideration consists of 15 Salter Ducks on a 300m spine. Transfer functions have been computed for horizontal and vertical transverse displacements of the spine, the Duck pitch angles, bending moments in the horizontal and vertical planes, horizontal and vertical transfer shear forces, and power extraction, corresponding to 15 locations along the spine, for all wave directions at 15/sup 0/-intervals, and for wave periods in the range 3.5s to 25s. Subsequently the responses of the Duck string to any sea state with any type of error could be determined. Three types of error were considered of which one was of the Gaussian form.

48476 **(ETSU-WV—1635-Pt.1) Assessment of Wave Data collected at Butt of Lewis and Holy Island by the National Maritime Institute.** (UKAEA Harwell Lab. Energy Technology Div.). Jul 1981. 75p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

From January 1979 to mid 1980 wave height data from the Butt of Lewis and from Holy Island was recorded by the National Maritime Institute, Hythe, onto FM magnetic tapes. In the first phase of this project, the tapes, charts and notes collected from NMI after the field work had ended were used to assess the completeness and quality of the data. In Phase II the tapes were replayed and the parameters wave height, period and power were computed from all good tapes. The overall data return at both sites was poor - 30% at Holy Island, and 6% at the Butt of Lewis, over the twelve months of 1979, although at both sites the data return was best during the first few months of the study. An inspection of the data would indicate a predominance of long period waves at both sites. Because of the incompleteness of the data sets it is difficult to verify their validity and it is suggested therefore that these results are treated with some circumspection.

48477 **(ETSU-WV—1641-P1) Study and cost estimation on the design, installation and maintenance of the moorings and anchorages for the British Cylinder Wave Energy Device.** (UKAEA Harwell Lab. Energy Technology Div.; Single Buoy Moorings (DBV) Ltd., Twickenham (UK)). Dec 1982. 105p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Design studies and costings of various aspects of the Bristol Cylinder Wave Energy Device are reported. The studies comprised design and cost estimate of the mooring leg, development and costing of procedures for maintenance of the mooring legs, and design and cost estimate of the anchorage, development and costing of procedures for installation of the anchorage and development and costing of procedure for device installation.

48478 **(ETSU-WV—1642-P1) Wave energy operation and maintenance parametric analysis.** Clark, L.E.J.; Harmsworth, B. (Easams Ltd., Camberley (UK)). (UKAEA Harwell Lab. Energy Technology Div.; Easams Ltd., Camberley (UK)). Feb 1982. 43p. (WESC—82-GT-169). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The work based on the use of the EASAMS' Wave Energy Maintenance Model, which has been developed for the assessment of the operation and maintenance aspects of wave energy systems is presented. For ease of understanding, a brief summary of the Model is included. The model is presented in two volumes. Volume 1 contains a systematic collation of maintenance information and assembles the maintenance data available within the community. It indicates the confidence that can be attached to this data, and shows up areas of unreliable data and, where necessary, provides a set of assumptions that can be used as a consistent basis until better data becomes available. Volume 2 provides a method of costing the maintenance of a wave energy system. The data from Volume 1 can be used as the input to Volume 2 to produce an annual operating cost for a 2GW array based on a particular device.

17 WIND ENERGY

1701 Availability (climatology)

REFER ALSO TO CITATION(S) 48375, 48485

1703 Regulations

48479 **(NP—8770306) Advantages of utilizing wind energy by means of jointly used systems.** Vogt, H. (Ministerium fuer Wirtschaft und Verkehr des Landes Schleswig-Holstein, Kiel (Germany, F.R.)). Apr 1986. 20p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770306/JAW.

Jointly used wind energy systems are wind power plants of up to 100 kW. The investigation deals with the question of how far jointly used wind energy systems would be able to help wind energy to be used as stand-by energy source in Schleswig-Holstein. Particularly emphasized are legal problems and problems relating to pricing and accounting. At the end, the author gives recommendations for the construction of jointly used wind energy systems. They cover all points from site selection to construction permit application.

1704 Economics

REFER ALSO TO CITATION(S) 48485

48480 **(PB—88-206057/XAB) Harnessing the wind using axial-flow wind turbines. Research report.** Esterhuyse, J.C. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Mechanical Engineering Research Inst.). Oct 1986. 112p. (CSIR-RR—619). NTIS, PC E07/MF E07.

Also pub. as ISBN 0-7988-3775-6; North American Continent sales only.

The main object of the work described in the report was to develop a wind-driven, power-generating system that would operate effectively in regions where strong winds do not prevail. A standard automotive alternator was modified to provide a suitable charging unit for a 36-volt bank of batteries. The torque required to overcome the static friction of the drive train was determined and a unique method of design was developed to match the available starting torque of a specific rotor with the required static torque of the drive train and charging unit. A rotor was designed according to the aerodynamics of axial flow wind turbines and a model was tested in the wind-tunnel of the Aeromechanics Division to establish the characteristics of its performance and starting torque.

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 48407, 48413, 48413

48481 **(ETSU-WN—5052/1) Finite element analysis of wind turbine systems.** Garrad, A.D.; Patel, M. (UKAEA Harwell Lab. Energy Technology Div.; Flight Refuelling Ltd., Wimborne (UK)). Apr 1987. 40p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

It is now generally accepted that the dynamic characteristics of a wind turbine must be included in any model used to predict loads. The supporting towers are becoming more flexible as designs develop and hence they also must be included in the models. Traditionally the helicopter industry, which shares many of the modelling problems encountered with wind turbines, uses a model approach to characterise the dynamic components of the system. To include the tower and the rotor in such a model creates some very tedious algebraic problems and tends to produce models that are very specific to the type of machine under investigation. The viabil-

ity of using a finite element approach to compute the coupled rotor-tower aeroelastic response of a wind turbine was examined.

48482 **(ETSU-WN—5061/1) Aerodynamic control of horizontal axis wind turbines.** Brocklehurst, A.; Hawkings, D.L. (Westland Helicopters Ltd., Yeovil (GB); Westland System Assessment Ltd., Yeovil (GB)). (UKAEA Harwell Lab. Energy Technology Div.; Westland System Assessment Ltd., Yeovil (UK)). Jun 1987. 169p. (WSAR—610). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Aerodynamic control for horizontal axis wind turbines has been explored by reviewing the available literature and by writing a computer program to model the aerodynamic performance. The computer model is based on blade element-momentum theory and uses a large angle formulation which contains swirl. The program compares well with other momentum models and test data. Aerodynamic control techniques have been compared by studying their effect on performance and blade loading, and also on the emergency shut-down case which has been modelled by numerical integration of the aerodynamics. The control method which has been found most suitable for large horizontal axis wind turbines is fully variable pitch. Feathering the blades in high winds minimises the aerodynamic loads and should therefore permit blade weight to be minimised. Other advantages are positive speed control, facility for power smoothing, reduction of fatigue loads and maximising energy capture. Part span variable pitch may be an attractive option if it can be shown to provide a more economic solution.

48483 **(ETSU-WN—5075/1) Effects of Reynolds number of unsteady flow response of NACA 0020 aerofoil. Final report.** (University Coll., London (UK)). 1988. 50p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Details are given of further work concerned with the unsteady flow responses of an aerofoil section subjected to conditions that are typically experienced by vertical axis wind turbines (VAWT). Use has been made of the UCL Open Jet Wind Tunnel, with modifications required for the present series of tests, and the VAWT Simulation Rig. Emphasis has been placed on determining the effects of Reynolds number changes on blade pressures and integrated pressure forces. This has required the design and build of a new and larger aerofoil section compared with those used hitherto. The data reported refer only to the NACA 0020 section subjected to a range of jet wind speeds, VAWT rig rotational speeds and angle of attack variations. From these variables Reynolds number and reduced frequency effects can be deduced.

48484 **(SAND—88-7021) A model for the response of vertical axis wind turbines to turbulent flow: Parts 1 and 2.** Malcolm, D.R. (Sandia National Labs., Albuquerque, NM (USA); Indal Technologies, Inc., Mississauga, Ontario (Canada)). Jul 1988. Contract AC04-76DP00789. 221p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88014708/JAW.

This report describes a project intended to incorporate the effects of atmospheric turbulence into the structural response of Darrieus rotor, vertical axis wind turbines. The basis of the technique is the generation of a suitable time series of wind velocities, which are passed through a double multiple streamtube aerodynamic representation of the rotor. The aerodynamic loads are decomposed into components of the real eigenvectors of the rotor and subsequently into full-power and cross-spectral densities. These modal spectra are submitted as input to a modified NASTRAN random load analysis and the power spectra of selected responses are obtained. This procedure appears to be successful. Results at zero turbulence agree with alternative solutions, and when turbulence is included, the predicted stress spectra for the Indal 6400 rotor are in good agreement with field data. The model predicts that the effect of turbulence on harmonic frequency peaks and on all lead-lag bending will not be great. However, it appears that only 11% turbulence intensity can almost double the rms of cyclic flatwise blade bending. 23 refs., 27 figs., 4 tabs.

48485 **(SERI/CP—217-3315) Windpower '87: Proceedings.** (Solar Energy Research Inst., Golden, CO (USA); American Wind Energy Association, Arlington, VA; USDOE, Washington, DC). 1987. Contract AC02-83CH10093. 456p. (CONF-871062—). NTIS, PC A20. Order Number DE88012681/JAW.

From Windpower '87; San Francisco, CA, USA (5 Oct 1987).

This report contains the papers given at the 1987 Windpower Conference. The topics covered are: wind turbine technology overviews; systems design; technology development; system operations; wind resources and siting; economic, regulatory, and environmental issues; hybrid systems and non-utility applications; and international programs and activities. (FI)

48486 **Aerodynamic interference of two vertical axis wind turbines.** Rajagopalan, R.G.; Klimas, P.C.; Rickerl, T.L. pp 174-184 of AIAA Applied Aerodynamics Conference, 6th, Williamsburg, VA, June 6-8, 1988, Technical Papers. Washington, DC; American Institute of Aeronautics and Astronautics (1988). (AIAA-Paper—88-2534; CONF-8806202—).

From 6. AIAA applied aerodynamics conference; Williamsburg, VA, USA (6 Jun 1988).

The laminar flow field and performance of clusters of two-dimensional vertical axis wind turbines are analyzed. Physical positioning of the turbines with respect to each other significantly affects the aerodynamic performance of the turbines. The incompressible flow field is dominated by the pressure field of the operating turbines and mutual interference is observed to be elliptic in nature. Several cases are examined starting with one pair of turbines to a cluster as big as twenty one turbines. From the two-dimensional cases presented here, it is concluded that downwind turbine performance can be improved by judiciously choosing the angular relative orientation of the turbines. Qualitative analysis of the laminar flow field is conducted with the help of streamline and pressure contours. Quantitative performance comparisons of the turbines are made with a stand alone turbine operating under similar flow conditions. This investigation lays the groundwork for the optimization of a wind farm. 35 references.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 48047, 48048, 48049, 48050, 48051, 48052, 48053, 48500, 48738, 48926, 48983, 49313, 49314, 49315

48487 **(CONF-871212—1) CFB-pressurized gasification in a combined cycle power plant. Final report.** Bade, H.; Schellenberg, K.D.; Plass, L.; Loeffler, J.C.; Mehrling, P. (Berliner Kraft- und Licht (BEWAG)-A.G. (Germany, F.R.); Lurgi G.m.b.H., Frankfurt am Main (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1987. 38p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770296/JAW.

From Advanced coal power plant technology and hot gas cleaning conference; Duesseldorf, F.R. Germany (2 Dec 1987).

Objectives of these project have been the demonstration of gasification with simultaneous desulfurization, determination of basic design data and the preparation of an engineering study of the CFB-pressurized gasification, gas turbine and heat recovery. During the pilot test gasification of different coal and simultaneous desulfurization have been demonstrated, sulphur capture up to 97% has been achieved, carbon conversion ranged between 60 and 80% and during combustion of gasification residue SO/sub 2/ emission of 10 mg/m/sup 3//sub n/ and NO/sub x/ emission of < 200 mg/m/sup 3//sub n/ have been demonstrated. The results of the study can be summarized as follows: CFB-pressurized gasification is feasible for application in combined cycle power plants, the efficiency of the combined cycle power plant is 40%, the estimation of costs of power generation showed a reduction of more than 11% compared with power generation costs of a conventional CFB-power plant. The positive results of the tests and the study performed can

be taken as a basis for the next step, the design, erection of a combined cycle power plant with CFB-pressurized gasification. (orig.) With 21 refs., 24 tabs., 24 figs.

48488 **(CONF-8510495—) Time-dependent processes and recognising damage in components of thermal plants.** (Hannover Univ. (Germany, F.R.). Sonderforschungsbereich 211 - Zeitabhaengige Vorgaenge und Schadenserkennung in Komponenten Waermetechnischer Anlagen). 1986. 162p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770381/JAW.

From Colloquium of the Special Research Group 211 on time-dependent processes and recognising damage in components of thermal plants of Hannover University; Hannover, F.R. Germany (3 Oct 1985).

In this report on the Colloquium of SFB 211, the lectures given at a day meeting at Hannover on October 3, 1985 are reproduced. All lectures introduced here fall into the following two main categories: Time-dependent processes in heat exchangers; recognising damage in components of thermal plants. (HAG).

48489 (CONF-8510495—, pp 67-78) **Application of correlation measuring technique for recognising damage.** Stegemann, D. 1986. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770381/JAW.

From Colloquium of the Special Research Group 211 on time-dependent processes and recognising damage in components of thermal plants of Hannover University; Hannover, F.R. Germany (3 Oct 1985).

Correlation measuring technique is used to recognise damage in parts of power station plants. One first examines what signals can be used to recognise damage. Different correlation functions are also introduced. Various signals, which are used for recognising damage, are also explained, with the associated measurement devices. (HAG).

48490 (CONF-8510495—, pp 79-91) **Results of investigations for recognising damage on different kinds of turbines.** Valero, M.; Suedmersen, U. 1986. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770381/JAW.

From Colloquium of the Special Research Group 211 on time-dependent processes and recognising damage in components of thermal plants of Hannover University; Hannover, F.R. Germany (3 Oct 1985).

The main point of this article is a method of examination which is to be used for recognising damage on different kinds of turbines. Possibilities of suppressing the interfering noise are introduced, joint information from pressure and body noise signals is shown, and signatures in the signals and their changes when damage occurs, are dealt with. The applicability of the analysis process to large turbines is explained using an example. (HAG).

48491 **(CRIE-U—87026) Optimum temperature-rise of passing through condenser and marine environment effect by reduction of cooling water rate.** Katano, Naoaki; Wada, Akira; Araki, Hiroshi; Kadoyu, Masanori. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Nov 1987. 29p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753444/JAW.

The temperature-rise of the water in passing through a condenser (T) at nuclear and thermal power plants is currently determined to be 7°C uniformly throughout Japan, but its basic reason is unknown. From the viewpoint of economics, it can be foreseen that raising the above temperature more than 7°C currently set could be beneficial depending upon the sea area concerned. In this report, the following investigations and studies were conducted with the aim to propose a rational T appropriate for the individual maritime environmental conditions: 1) Optimum temperature-rise in passing through a condenser against a water intake temperature. In case of newly constructed plants. -- A newly built coal fired thermal power plant with power output of 1,000MW was examined. The T's to minimize the cost from the viewpoints of the construction of the cooling water system equipment and the operation of the plant were 12.8°C and 8.2°C in each case of the design temperature of 15° and 22°C respectively. In case of existing power plants. -- As a result of the examination of two existing plants, it is economical to switch from two pump operation to one pump operation. 2) Effects of intaking and outreleasing water in association with a change of the cooling water rate. The entrainment region of fish-eggs decreases in proportion to the decrease of the intaking water rate. In general, it is beneficial to raise T. (12 figs, 10 tabs)

48492 **(DOE/PC/50270—T16) Plant equipment selection and performance using coal-water mixtures: Final report.** Shih, C.C.; Motley, E.P.; Meyers, R.A.; Jones, J.F.; Lim, W.Y.; Anastasi, J.L.; Liberman, A. (TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div.; Stone and Webster Engineering Corp., Boston, MA (USA)). Jul 1986. Contract AC22-82PC50270. 230p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88004153/JAW.

The objective of the TRW project was to generate a data base for equipment selection and design of the front end fuel delivery system for new coal water mixture (CWM) installations and for retrofits of existing fuel oil furnaces to CWMs. The project involved evaluating the performance of pumps and other plant equipment, pipes, fittings, valves, and instruments with CWMs supplied to several commercial vendors. The project also included an evaluation of CWM corrosive and erosive properties, and the correlations of measured CWM physical and rheological properties with observed hydraulic behavior in pipes and fittings. A CWM Test Facility was constructed at the TRW San Juan Capistrano test site. The test facility included both a low pressure loop for adjusting the CWM temperature and a high pressure loop to simulate burner operation. The results of testing CWMs at this facility are documented in this report, along with the design of a CWM supply system for a commercial boiler facility. The major findings from this study are: (1) CWMs can be stored for long periods with remarkable stability; (2) the Metzner-Reed model for homogeneous, non-Newtonian fluids is applicable to CWMs; (3) both the progressive cavity pump and the twin screw are highly suited for CWM service; (4) dependable on-line instrumentation are available for measuring temperature and pressure of CWMs and CWM properties; (5) carbon steel is an acceptable material of construction for most CWM applications; and (6) sufficient test data and operating experience are available for the design of CWM delivery systems for commercial boiler facilities. 13 refs., 43 figs., 16 tabs.

48493 **(EPRI-AP—5826-Vol.2) Residual fuel oil user's guidebook: Volume 2, Residual oil-fired boilers: Final report.** Thompson, R.E.; Shiomoto, G.H.; Muzio, L.J. (Electric Power Research Inst., Palo Alto, CA (USA); Fossil Energy Research Corp., Laguna Hills, CA (USA); Southwest Research Inst., San Antonio, TX (USA)). Aug 1988. 379p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016088/JAW.

The Residual Oil Users' Guidebook concerns the operation, performance, and emissions of oil-fired utility boilers. It was prepared to assist utilities in addressing technical issues associated with the handling, storage, and combustion of residual oil. Since efficient fuel utilization and boiler performance are directly dependent upon achieving complete combustion of residual fuels, the major emphasis is on atomization, combustion and emission control topics. State-of-the-art practices in firing residual oil in utility boilers are examined starting with the delivery of the fuel to the storage tanks and ending with the flue gas leaving the stack. The last guidebook section includes a detailed troubleshooting and diagnosis guide for convenient plant use in identifying and solving many residual oil-fired boiler problems. 211 refs., 115 figs., 20 tabs.

48494 **(EPRI-AP—5844) Thermal energy storage for advanced Compressed-Air Energy Storage plants.** Nakhamkin, M. (Electric Power Research Inst., Palo Alto, CA (USA); Gibbs and Hill, Inc., New York (USA)). Jul 1988. 128p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88014904/JAW.

Two R and D studies have been completed: analysis and conceptual engineering of Compressed-Air Energy Storage (CAES) plants utilizing the stored heat of compression in thermal-energy

storage (TES) to preheat air entering the expander train; and analysis and conceptual engineering of CAES plants utilizing the stored heat of compression to generate steam for injection into the expander train during the generation cycle. The following data resulting from these studies is included: detailed descriptions, preliminary engineering, performance, and cost evaluation of major components including turbomachinery and balance-of-plant systems and equipment, for selected CAES-plant concepts with TES; and comparative technical and economic analyses of various CAES-plant concepts utilizing TES versus a conventional CAES-plant concept. 3 refs., 32 figs., 13 tabs.

48495 **(EPRI-EL—5944) Pyrolysis and combustion products of selected utility materials: Final report.** Sack, T.M. (Electric Power Research Inst., Palo Alto, CA (USA); Midwest Research Inst., Kansas City, MO (USA)). Jul 1988. 246p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88014903/JAW.

A variety of utility materials, such as papers, dielectric fluids, insulation materials, and polymers, were studied to evaluate their potential to generate undesirable thermal degradation products under fire conditions. A combined pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS) system was used to pyrolyze and/or combust the materials followed by GC/MS analysis of their products. Products were tentatively identified by computerized library searches and by manual interpretation. The pyrolysates of the utility materials were compared with those produced by maple wood. Those materials of similar structure to maple wood--Kraft papers, pressboard, and rag paper decompose yielding common products with the maple wood. Materials containing only carbon, hydrogen, and/or oxygen other than the wood derivatives, Midel, polyethylene, Edisol, and Wemcol, produce primarily alkanes, alkenes, alkylated benzene derivatives, and some polycyclic aromatic hydrocarbons (PAHs) that are characteristic of the bulk material. Those materials containing heteroatoms other than carbon, hydrogen, and oxygen, such as nitrogen or sulfur, typically produce unique thermal decomposition products that are characteristic of the original material. Creosote yields a complex mixture of PAHs, nitrile rubber produces nitriles and alkylated benzenes, and Nomex produces several molecules that contain nitrogen, but are not identifiable using the present methods. The nonvolatile chlorine-containing materials, PVC and Electrochem, produce chlorobenzenes and are therefore potential precursors of larger, more highly chlorinated molecules that are of current environmental interest. 11 refs., 3 figs., 14 tabs.

48496 **(EPRI-P—5711) EPRI fuel forecast review: Volume 2, 1988 reports.** (Electric Power Research Inst., Palo Alto, CA (USA); Putnam, Hayes and Bartlett, Inc., San Francisco, CA (USA)). Jul 1988. 281p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88014889/JAW.

The Fuel Forecast Review project provides a vehicle for the ongoing review and analysis of fuel market forecasts. The project is designed to produce periodic reports that include an annual overview of current forecasts, together with reviews of forecast updates as they become available, special fuel forecasting topical studies, and more detailed overviews of individual forecast systems from a utility fuel perspective. The EPRI Fuel Forecast Review Report Binder, a loose-leaf project notebook, was developed by Putnam, Hayes & Bartlett, Inc. for the Electric Power Research Institute under EPRI Project RP (2369-20). This volume documents the results of the Fuel Forecast Review project by providing a binder for storing the reports that are generated in the course of this project as they become available.

48497 **(EPRI-P—5832) Decision analysis applied to utility fuel planning and management: A tutorial and casebook: Final report.** Robinson, B.E. (Electric Power Research Inst., Palo Alto, CA (USA); Strategic Decisions Group, Menlo Park, CA (USA)). Jun 1988. 212p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88012780/JAW.

Decision analysis offers quantitative methods for dealing consistently, logically, and thoroughly with the uncertainties and complexities in today's utility fuel planning environment. In this report, the basic concepts and techniques of decision analysis are applied to several examples of decisions facing utility fuel planners: coal miner development strategy, contract mix decisions, and fuel inventory policy. Tutorial in style, this report provides readers with an introduction to decision analysis before they go on to use the more advanced models available from EPRI. 57 figs., 23 tabs.

2002 Environmental Control Technology

REFER ALSO TO CITATION(S) 48081, 48082, 48125, 48369, 48434, 48492

48498 **(EPRI-CS—5879-CCM) Flue Gas Desulfurization Information Resource Manager (FGDIRM) Software Reference Manual.** (Electric Power Research Inst., Palo Alto, CA (USA); Radian Corp., Austin, TX (USA)). Aug 1988. 73p. Unlimited audience, publicly available.. Order Number TI88015251/JAW.

In response to the data management needs of utility FGD systems, EPRI has sponsored the development of a computer program, the FGD Information Resource Manager (FGDIRM), designed to help efficiently manage the data associated with an FGD system and to perform calculations essential for monitoring the performance of an FGD process. FGDIRM is an integrated software package consisting of five application programs -- the Laboratory Data Manager, the Process Data Manager, the Mass balance, the Data Presentations application, and the Configuration application -- each designed to address specific needs in FGD data management. FGDIRM may be run on IBM compatible personal computers with 512 kilobytes of main memory and a hard disk. Typical uses of FGDIRM would be to assist in the routine monitoring of an FGD system or to help with troubleshooting activities by "recreating" events based on historical data. By efficiently managing process chemistry data from flue gas desulfurization systems, the FGDIRM integrated soft ware package can contribute to improved system reliability, performance, and cost-effectiveness. Sample FGDIRM applications include monitoring, optimizing, and troubleshooting system performance.

48499 **(NP—8770295) NO/sub x/-reduction tests on coal-fired slag-tap furnace with multiple over fire air burners. Final report.** Benesch, W.; Boltendahl, U.; Hannes, K.; Strauss, K. (STEAG-Kraftwerksbetriebsgesellschaft m.b.H., Essen (Germany F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 30 Jun 1987. 113p. (In German). NTIS (US Sales Only), PC A06. Order Number DE88770295/JAW.

Gradual air-input into the burner section was tested in a sectional slag-tap furnace of a 350 MW unit. Information was to be obtained about the influences of the converted burner system and the modified grinding plant on NO/sub x/ generation. At the same time corrosion provoked by the generation of CO and H/sub 2/S should be avoided. These gradual air-input tests showed that a considerable NO/sub x/ reduction is feasible. A prerequisite is that the grinding fineness be adapted to the coal blend. Air-input into the burner section must be gradual along the burn-out distance in order to avoid high local air excess. Optimum NO/sub x/ values are obtained with air excess in the burner section at n=0.8. This guarantees sufficiently stable ingnition. (orig.) With 60 refs., 51 figs.

48500 **(NP—8770297) High incombustibles hard coal-fired low NO/sub x/-type power station with a combined DeNO/sub x/ concept. Project preparation and project phases. Final report.** Benesch, W.; Brosch, D.; Hannes, K.; Oeking, K. (STEAG A.G., Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 30 Jun 1987. 213p. (In German). NTIS (US Sales Only), PC A10. Order Number DE88770297/JAW.

For the development of a low NO/sub x/-type power station concept for new plants tests were made to investigate how actual emission data can be kept considerably below the limits laid down in the German Regulation on Industrial Furnaces. These tests encompassed multi-stage fuelling and multi-stage air inlet combined with selective high temperature reduction and NO/sub x/ reduction by EDTA salts in the flue gas scrubber. According to a deci-

sion by the Conference of the State Ministers for Environment (UMK) the acceptance test for ferric oxide catalysts was integrated into the programme. The test results showed that the UMK limits can be achieved by multi-stage fuel and air, input combined with a selective high temperature reduction, if the boiler, furnace and fuel handling are designed accordingly. Retrofitting of existing plants with this process is generally impossible. (orig.) With 59 refs., 110 figs.

48501 **(NP—8770356) Report of the working group 'Energy demand - environment - power plant operation'.** (Staatsministerium Baden-Wuerttemberg, Stuttgart (Germany, F.R.)). 1983. 212p. (In German). NTIS (US Sales Only), PC A10. Order Number DE88770356/JAW.

The main reason for the direction to undertake the investigation is the question of how - when taking future energy demand and all technical and economical possibilities into consideration - at short notice an ecologically beneficial power plant operation can be guaranteed, over middle and long term. After an introduction into the problematic nature, the following subjects are treated, in three separate sections: 1. state-of-the-art of procedures to reduce SO/sub 2/ emission and costs: analysis of effectiveness for plants of EVU (energy supply company), 2. EVU-measures within the framework of the Industrial Furnaces Ordinance and of the 'Contract of the Century' and its effects on SO/sub 2/ emissions, 3. validation of EVU strategies by way of examining further theoretical possibilities of reducing SO/sub 2/ emissions.

48502 **An outboard shield design for TIBER-II with potential for tritium self-sufficiency.** Sawan, M.E.; Sviatoslavsky, I.N. (Fusion Technology Institute, Univ. of Wisconsin-Madison, 1500 Johnson Drive, Madison, WI (US)). pp 1283-1286 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

The outboard breeding shield design for TIBER-II is described. The design allows for tritium self-sufficiency without compromising magnet protection, design simplicity, and the testing mission of the device. The shield consists of a beryllium pebble front zone backed by a steel pebble zone. The shield is cooled by an aqueous solution containing 16 g LiNO/sub 3/ per 100 cm/sup 3/. A double first wall is used to insure uniform cooling and minimize pressure. The design pressure for the outboard shield is 0.19 MPa and the coolant temperature is less than 75°C.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 49241

48503 **(CRIE-T—86119) Study on dynamic transition process to new distribution voltage of 400V class.** Fukutome, Atsushi; Watanabe, Masato; Okamura, Yukihiro. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Sep 1987. 47p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753439/JAW.

Employment of 400V class distribution voltage enables public consumers to increase their usable electric energy and expand its utilization with no increased energy loss and excessive voltage drop. In Japan too, it is deemed preferrable to employ eventually 400V class secondary distribution voltage which is highly common internationally, following employment of 20kV class primary distribution voltage. This article studies particularly technical problems to be solved for raising secondary distribution voltage and provides an orientation towards the preferred scenario of raising voltage and the preparatory policy therefor. In other words, concerning the voltage increase for consumers' electric appliances, a period of 10-20 years is to be provided and during this period, single-phase three-wire indoor distribution circuits and 200V-rated equipment or double-rated 100/200V equipment are to be brought into wide use while efforts should be made to obtain consumers' good understanding. For this, a policy should be established taking into account the possible utilization of voltage in a range between 190 and 240V. With respect to the voltage increase of supply facilities, the report evaluates the preceding employment of voltage raising to 20kV class primary distribution voltage, the simultaneous employment of voltage raising of both primary and secondary distribution voltages, and the preceding employment of voltage raising to 400V class secondary distribution voltage. (23 figs, 12 tabs, 4 refs)

48504 **(EPRI-EL—5472-Vol.3) Power line fault current coupling to nearby natural gas pipelines: Volume 3, Analysis of pipeline coating impedance: Final report.** Dabkowski, J.; Frazier, M. J. (Electric Power Research Inst., Palo Alto, CA (USA); American Gas Association, Inc., Arlington, VA; Science Applications International Corp., Hoffman Estates, IL (USA)). Aug 1988. 123p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016087/JAW.

This report is a compilation of results obtained from two research programs. The response of a pipeline and coating at the higher voltage excitation levels encountered under power line fault conditions appears to be dominated by conduction at holiday sites in the coating. A simple analytical model was developed for predicting the resistance of a pipeline coating holiday as a function of the voltage produced across the pipeline coating by a nearby faulted power transmission line. The model was initially validated using coated pipeline samples stressed by a capacitive discharge voltage. Additional validation tests were then performed at the Pacific Gas and Electric Company's High Voltage Engineering Research Facility using high voltage ac waveforms for fault simulation. The principle program objective was to develop, both by laboratory and controlled field testing, an electrical resistance characterization for the pipeline coating as a function of the applied voltage level. The development of this model will allow a more accurate prediction of coupled voltage levels to a pipeline during fault current conditions. 54 figs, 3 tabs.

48505 **(EPRI-EL—5852) State of the art of high-voltage solid-dielectric cable systems: Recommendations for improvement: Final report.** Engelhardt, J.S. (Electric Power Research Inst., Palo Alto, CA (USA); Underground Systems, Armonk, NY (USA)). Jul 1988. 64p. (TPS—82-631). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88013112/JAW.

This study was undertaken to explore and define the state of the art through 1983 in the area of extruded dielectric high voltage transmission cables. To this end, the study included an extensive review of available literature, the development of an historical summary of the evolution of the technology, and a specific project-by-project critique of relevant Electric Power Research Institute (EPRI) funded projects. The findings of the study emphasize the difficulties in utilizing the extraordinary high temperature capability of thermosetting polymers when assembled into realistic cable constructions. Thermal expansion and contraction are shown to present severe design problems for insulation shield systems, sheaths, coverings and accessories. Such problems have dominated qualification and demonstration projects, resulting in low confidence levels for this underground transmission alternative. 4 tabs.

48506 **(EPRI-EL—5880) Thermomechanical bending effects on extra-high voltage pipe-type cables: Final report.** Aabo, T.; Moran, J.A. (Electric Power Research Inst., Palo Alto, CA (USA); Power Technologies, Inc., Schenectady, NY (USA)). Jul 1988. 252p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88014203/JAW.

This report summarizes the results of a comprehensive project to quantify the thermo-mechanical bending (TMB) behavior of different constructions of Extra High Voltage (EHV) pipe-type cables. The project was undertaken because of industry concern with electrical failures of joints and many removals-before-failure on EHV cable systems due to thermally-induced bending in the joint casings. The characterization of TMB behavior is based on analysis and on mechanical testing of a large number of cable samples representing cable constructions ranging from 1960's construction to experimental cables being developed under other EPRI projects. Present cable designs were found to be highly resistant to softspot formation even when subjected to extreme movement and

for large numbers of cycles. Earlier cable designs are softspot-resistant but to a lesser extent; these cables develop softspots under extreme test conditions. Optimized cable construction and experimental cables both were found to be resistant to softspot formation. Separate projects undertaken by cable-using utilities have resulted in joint restraints that appear to have eliminated the TMB problem. The present project is concerned with TMB behavior in the line pipe. 98 refs., 11 figs., 10 tabs.

48507 (EPRI-EL—5915-Vol.1) Conduct and interpretation of load tests on drilled shaft foundations: Volume 1, Detailed guidelines: Final report. Hirany, A.; Kulhawy, F.H. (Electric Power Research Inst., Palo Alto, CA (USA); Cornell Univ., Ithaca, NY (USA). Geotechnial Engineering Group). Jul 1988. 365p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88014502/JAW.

Load tests provide the only reliable basis for verification of an analysis/design methodology for deep foundations. No satisfactory guidelines currently exist which provide engineers with consistent procedures for conducting and interpreting load tests on drilled shafts. In this study, the factors influencing the response of a drilled shaft to load are evaluated, and rational and consistent criteria are developed for the proper conduct and interpretation of load tests for the following loading modes: axial compression and uplift, lateral and moment, torsion, and combined loading. The items addressed include geotechnical characterization of the test site, load test planning and documentation, equipment and hardware, instrumentation, data recording and presentation, load testing procedures, and interpretation of test results. 563 refs., 146 figs., 68 tabs.

48508 (EPRI-EL—5938) Active filters for high-voltage direct-current (HVDC) converter terminals: Final report. Mohan, N.; Wong, C. (Electric Power Research Inst., Palo Alto, CA (USA); Minnesota Univ., Minneapolis (USA)). Aug 1988. 49p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015352/JAW.

This report evaluates the technical and economic feasibility for active filtering of dc-side voltage harmonics and the ac-side current harmonics produced by a HVDC converter. The following designs for the active filter concepts are compared with the existing ac-side and dc-side passive filters used at the Dickinson terminal of the CU HVDC transmission line project: the dc-side active filter consisting of a capacitor coupled current injection source to actively "neutralize" the 12th, 24th and the 36th harmonics and, the ac-side active filter designed to provide the same fundamental frequency reactive VARs as the existing passive filters. Controlled currents are injected to actively filter the 11th and the 13th harmonic currents. A cost comparison is made between these active filter designs and existing passive filters supplied by the United Power Association (UPA). 22 figs., 11 tabs.

48509 (EPRI-EL/NP/CS—5914-SR) Workshop on power plant cable condition monitoring: Proceedings. Del Valle, L. (Electric Power Research Inst., Palo Alto, CA (USA)). Jul 1988. 324p. (CONF-880299—). Unlimited audience, publicly available. Research Reports Center, Box 50490 Palo Alto, CA 94303. Order Number TI88014886/JAW.

From Workshop on power plant cable condition monitoring; San Francisco, CA, USA (16 Feb 1988).

A three-day workshop on cable condition monitoring was held in San Francisco on Fegruary 16--18, 1988. The workshop was cosponsored by the Nuclear Power, Electrical Systems, and Coal Combustion Systems Divisions of the Electric Power Research Institute. The primary objective of the workshop was to identify the state-of-the-art for cable condition monitoring. Twenty-five technical papers as well as EPRI research programs were presented at the technical sessions. Four working group sessions and one general session were held on each of two days. Each group session provided a forum for participants to exchange ideas and to discuss in more depth research for cable condition monitoring, existing and innovative testing technology, and utility and NRC needs for testing. Recommendations from the working groups were summarized and presented at the end of the workshop.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 48613, 48614, 48664, 48731, 49701, 50307

48510 (INIS-BR—1147-Vol.2) Proceedings of the 2. General Congress of Nuclear Energy. Vol. 2. (Associacao Brasileira de Energia Nuclear, Rio de Janeiro). 1988. 498p. (In Portuguese). (CONF-880440—). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW.

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

In this volume, the papers arranged in the following fields: design and construction of nuclear power plants; advanced technologies; mathematical and computer models; safeguards and nuclear laws; industrial applications of radioisotopes; fuel cycle; and radiochemistry, are presented. (M.C.K.).

48511 (NUREG—0020-Vol.12-No.7) Licensed operating reactors: Status summary report data as of June 30, 1988. (Nuclear Regulatory Commission, Washington, DC (USA)). Jul 1988. 527p. NTIS, PC A23/MF A01 - GPO. Order Number TI88015470/JAW.

The US Nuclear Regulatory Commission's monthly Licensed Operating Reactors Status Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This information is collected by the office of Information Resources Management, from the Headquarters Staff of NRC's Office of Inspection and Enforcement, from NRC's Regional Offices, and from utilities. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 48567, 48588, 48595, 48633, 48637, 48640, 48643, 48644

48512 (DOE/ET/34213—15) Development of an extended burnup mark B design: Twelfth progress report, July 1986--June 1987. (Babcock and Wilcox Co., Lynchburg, VA (USA). Lynchburg Research Center). May 1988. Contract AC02-78ET34213. 58p. (BAW—1532-12). NTIS (US Sales Only), PC A04; 1; GPO Dep. Order Number DE88011805/JAW.

This report, covering July 1986 through June 1987, is the twelfth progress report for the project. During this time, the four extended burnup lead test assemblies (Mark BEBs) and four characterized baseline Mark B assemblies completed their third cycle of irradiation in ANO-1 cycle 7, which marks the end of the irradiation portion of this project. Post-irradiation data were collected at poolside, and these data are being reduced and evaluated. The Mark BEB assemblies have accumulated a burnup of 47,310 MWd/mtU and a core-average exposure of 1289 effective full-power days. The incore performance of the Mark BEB assemblies was monitored. Comparisons between measured and predicted relative powers were very good, and all parameters measured indicated that the assemblies performed well. 36 refs., 27 figs., 9 tabs.

48513 (EGG-M—33287) Technical safety issues associated with aging and license renewal of BWR [boiling water reactor] piping. Buescher, B.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-880748—9). NTIS, PC A02. Order Number DE88015138/JAW.

From American Nuclear Society topical meeting on nuclear power plant life extension; Snowbird, UT, USA (31 Jul 1988).

Time-dependent degradation of the boiling water reactor (BWR) primary coolant piping, recirculation piping main feedwater

piping, and steam lines has a significant impact on the safe operation and license renewal of aging plants. This paper discusses the dominant degradation mechanisms active in these piping systems. It discusses intergranular and transgranular stress corrosion cracking in sensitized and nonsensitized stainless steels, effects of fatigue and corrosion fatigue on carbon steel, erosion/corrosion of carbon steel in single-phase (water) and mixed-phase (water/steam) environments, and the effect of hydrogen water chemistry on piping degradation. Finally, this paper identifies the principal technical issues associated with aging of BWR piping.

48514 **(EPRI-NP—5947) Swedish utility experinece with ASEA-ATOM-design top guides: Final report.** Unneberg, L. (Electric Power Research Inst., Palo Alto, CA (USA); ABB ATOM AB, Vaesteras (Sweden)). Aug 1988. 27p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015681/JAW.

The main features of the 16 core grids (top guides) designed by ABB ATOM AB are briefly described and the evolution of the design is discussed. One important characteristic of the first nine grids is the existence of bolts securing guide bars to the core grid plates. These bolts are made of precipitation hardened or solution annealed stainless steel. During operation, bolts in all none grids have cracked. The failure analyses indicate that intergranular stress corrosion cracking (IGSCC), possibly accelerated by crevice conditions and/or irradiation, was the cause of failure. Fast neutron fluences approaching or exceeding the levels considered as critical for irradiation assisted stress corrosion cracking (IASCC) will be reached in a few cases only. Temporary measures were taken immediately after the discovery of the cracking. For five of the nine reactors affected, it was decided to replace the complete grids. Two of these replacements have been successfully carried out to date. IASCC as a potential future problem is discussed and it is pointed out that, during their life times, the ABB ATOM core grids will be exposed to sufficiently high fast neutron fluences to cause some concern.

48515 **(EPRI-NP—4574-CCM-Pt.2-Ch.1) ARMP-02 documentation: Part 2: Chapter 1, Code summary.** Eich, W.J. (comp.). (Electric Power Research Inst., Palo Alto, CA (USA)). Aug 1988. 34p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015531/JAW.

This document is a summary of the code library chapters and code manuals which comprise Part 2 of the ARMP-02 documentation.

48516 **Removable check valve for use in a nuclear reactor.** Dunn, C.; Gutzmann, E.A. (to Dept. of Energy, Washington, DC). US Patent 4,749,542. 7 Jun 1988. Filed date 7 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

In a pool-type nuclear reactor, a removable check valve assembly for interconnecting a discharge duct of a pump and an inlet coolant duct of a reactor core in the pool-type nuclear reactor, the valve assembly is described comprising: a manifold assembly having an outer periphery affixed to and in fluid communication with the discharge duct of the pump and an inner periphery having at least one opening therethrough; a check valve assembly including a housing having upper and lower ends, and at least two seal means, each extending about the outer periphery of the upper end of the housing, one being located above and the other below the opening in the housing.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 48512, 48515, 48516, 48588, 48589, 48591, 48593, 48595, 48618, 48629, 48630, 48631, 48633, 48634, 48637, 48639, 48640, 48641, 48645, 48646, 48647, 48648, 48650, 48984

48517 **(EGG-M—31787) Aging degradation of major LWR [light water reactor] components.** Shah, V.N.; Conley, D.A.; MacDonald, P.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 10p. (CONF-880748—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015139/JAW.

From American Nuclear Society topical meeting on nuclear power plant life extension; Snowbird, UT, USA (31 Jul 1988).

This paper summarizes the results of the Aging Mitigation Project sponsored by the US Nuclear Regulatory Commission–Office of Research. The objective of this project is to understand and manage aging degradation of the major light water reactor (LWR) structures and components. The main purpose of this project is to integrate, evaluate, and update the available and relevant aging-related information. This paper discusses current accomplishments and summarizes the significant degradation processes active in the pressurized water reactor primary coolant system piping, feedwater piping, and nozzles. It evaluates the effectiveness of the current inservice inspection programs to detect degradation damage. Finally, it identifies the technical issues that need to be addressed to develop life assessment procedures.

48518 **(EGG-M—88069) TMI [Three Mile Island]-2 defueling conditions and summary of research findings.** Eidam, G.R.; Tolman, E.L.; Broughton, J.M.; McCardell, R.K.; Stratton, W.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 25p. (CONF-880309—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015103/JAW.

From International symposium on severe accidents in nuclear power plants; Sorrento, Italy (21 Mar 1988).

The Three Mile Island Unit 2 accident was severe, with extensive melting of fuel, release of fission products, and relocation of a large quantity of molten fuel material onto the reactor vessel lower head. This molten material challenged the integrity of the reactor vessel, which remained intact. The post-accident condition of the plant presented an extremely difficult and complex plant recovery. Core defueling necessitated the development and use of tools and the application of methods not used previously in the nuclear industry. During the past 9 years, the TMI-2 accident has been a unique, invaluable source of information for improving and expanding the base of knowledge on severe accidents in power reactors. This paper presents the plant's post-accident condition, summarizes the primary results of research on progression of core damage and fission product behavior during the accident, and discusses the approach to defueling the reactor.

48519 **(EPRI-NP—5916) Mixed turbulent convective heat transfer in vertical ducts: Final report.** Catton, I.; Swanson, L. (Electric Power Research Inst., Palo Alto, CA (USA); California Univ., Los Angeles (USA)). Jul 1988. 65p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015210/JAW.

A recently developed heat transfer correlation can help determine acceptable water temperatures during a severe overcooling of the reactor vessel downcomer. This study contributes to an ongoing effort to prevent thermally induced cracking in reactor vessels. Thermally induced cracking develops when cold water suddenly contacts hot metal walls. This phenomenon could occur during certain PWR transients. Following an extensive literature survey, investigators built an experimental test facility to simulate the heat transfer phenomena found in a PWR reactor downcomer. The facility design emphasized reproducing the horizontal and vertical aspect ratios and the correct flow boundary conditions. The investigators selected Freon 113 as a working fluid to attain correct buoyancy forces with minimal wall heating. They then used the facility to test several inlet flows and temperature distributions using

a wide range of Prandtl, Reynolds, and Grashof numbers. Thermocouples distributed at various elevations and distances from the walls measured heat fluxes and temperature profiles. The experimental observations allowed a detailed analysis of turbulent flow in the downcomer, from which the team developed a theoretical model of the heat transfer mechanisms. Surface renewal theory provided a starting point for the theoretical investigation. The key product of this study is a heat transfer correlation that accurately represents the impact of the parameters. This correlation fits the experimental data within 7% over Prandtl, Reynolds, and Grashof numbers spanning the thermal-hydraulic conditions commonly found in PWRs. 35 refs., 31 figs.

48520 **(EPRI-NP—5960-SR) PWR primary water chemistry guidelines: Revision 1: Special report.** (Electric Power Research Inst., Palo Alto, CA (USA)). Aug 1988. 110p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015682/JAW.

The purpose of these guidelines is the development of a standardized chemistry program to ensure fuel and material integrity and control of plant radiation fields. This report, "PWR Primary Water Chemistry Guidelines, Revision 1" presents recommended generic water chemistry specifications, provides a basis for each parameter and limit, suggests responses to degraded water chemistry, and presents chemical analysis methods, outlines data management and surveillance schemes, and discusses the management philosophy required to successfully implement a water chemistry control program. This report also presents information on reactor cooling system chemistry during cooldown, addresses chemistry control in auxiliary systems.

48521 (INIS-BR—1147-Vol.1, pp 21-29) **Sensitivity analysis of FRAPCON-1 computer code to some parameters.** Chia, C.T.; Silva, C.F. da. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A sensibility study of the Code FRAPCON-1 was done for the following input data: number of axial nodes, number of time steps and the axial power shape. In the radial direction, which is the predominant in the heat transfer, the code keep the number of radial nodes fixed. Their influence in the code response concerning to the fuel centerline temperature, stored energy, internal gas pressure, clad hoop strain and gap width were analyzed. The number of axial nodes has little influence, but care must be taken in the choice of the axial power profile and the time step length.

48522 (INIS-BR—1147-Vol.1, pp 31-41) **Probabilistic analysis of the loss of external eletric power in Angra-1 considering uncertainty propagation.** Frutuoso e Melo, P.F.F.; Lima, J.E.P.; Fleming, P.V.; Oliveira, L.F.S. de. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Posgraduacao de Engenharia). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

To fulifill the needs of the probabilistic safety assessment for the Angra 1 nuclear power plant, a computer code for performing event tree analyses ETAP2, has developed in PASCAL language for the Burroughs B-6700 computer. The code employs the impact vector method. A dependency matrix is defined which allows for proper consideration of all relevant intersystem dependencies. The analyses are carried out to the subsystem (train or channel) level. The uncertainty analysis is performance on the dominant accident sequences lumped in two different groups: one for assessing the core-degradation-class frequencies and another for obtaining the core-degradation frequency concerning the initiator under analysis. For this purpose we use a discrete Monte Carlo algorithm which is faster than others available besides furnishing reliable results. The Loss-Of-Offsite power initiator analysis is presented for illustration purposes. The ETAP2 current version is implemented in the VAX 11/780 computer.

48523 (INIS-BR—1147-Vol.1, pp 43-48) **Jet forces inside the vessel containment caused by ruptures in the main feedwater system of Angra-2 nuclear power plant.** Alves, M.C.T. (NUCLEN, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

In the licensing of Nuclear Power Plants the loads caused by postulated ruptures in pipings and components of systems, which contain coolant at high pressure or high temperature must be analysed. The calculated loads originated by the postulation of these ruptures are considered in the design of components and civil structures of the plant, and are divided in jet, reaction and differential pressures forces. In this paper are presented the results of the jet force calculations for postulated ruptures in the Main Feedwater System inside the Containment of the Nuclear Power Plant Angra 2.

48524 (INIS-BR—1147-Vol.1, pp 81-86) **Licensing of the first reloaded mixed core for Angra-1 reactor.** Galetti, M.R.S.; Camargo, C.T.M. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro. Dept. de Reatores). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Different fuel element designs loaded in a nuclear core make necessary to demostrate full compatibility or minor differences before getting the license of returning to operation. For Angra 1 NPP, the first reloaded core presents on third of KWU fuel elements and two thirds from Westinghouse type. Differences in spacer grids affected features of the original core thermal hydraulic design as pressure losses and transverse flow pattern potentially changing the original MDNBR design basis. The license procedure adopted by CNEN is briefly presented.

48525 (INIS-BR—1147-Vol.1, pp 87-95) **Model description for calculating the source term of the Angra 1 environmental control system.** Oliveira, L.F.S. de; Amaral Neto, J.D.; Salles, M.R.; Ogawa, I.; Lima Filho, R.M. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Posgraduacao de Engenharia; FURNAS, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

This work presents the model used for evaluation of source term released from Angra 1 Nuclear Power Plant in case of an accident. After that, an application of the model for the case of a Fuel Assembly Drop Accident Inside the Fuel Handling Building during reactor refueling is presented.

48526 (INIS-BR—1147-Vol.1, pp 149-154) **Study of fuel enrichment for Angra-1 reloads.** Dias, A.M.; Sakai, M.; Teixeira, M.C.C. (NUCLEN, Rio de Janeiro (Brazil); NUCLEBRAS, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The fuel enrichment for PWR's reloads is a function of reload scheme, number of fuel assemblies per reload, cycle lenght and discharge burnup. For the future reloads (out-in) of Angra 1 calculations were performed for diferent fuel assembly batches 32, 36, 44 and 48 per reload batch up to the equilibrium cycle for 2 diferent enrichments 3.4 w/o and 3.9 w/o in U235. The results showed that for the enrichments used it is possible to reach cycle lenghts between 222 and 364 full power days.

48527 (INIS-BR—1147-Vol.1, pp 155-160) **Study of criticality for compact storage of Angra-1 type spent fuel elements.** Teixeira, M.C.C.; Dias, A.M. (NUCLEBRAS, Rio de Janeiro (Brazil); NUCLEN, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A preliminary study to establish the acceptable separation, from a criticality safety standpoint, among ANGRA-1 type fuel assemblies in the spent fuel pool has been done. The study aims to find a compact fuel storage also. The fuel enrichment was taken equal to 3.5 w/o with zircaloy-4 guide tubes and stainless steel spacer grid. Each fuel assembly was considered enveloped by an absorber borated steel alloy channel 0.3cm thick, with boron content between 0.8 w/o and 1.2 w/o. The temperature of 20/sup 0/C has been taken for the whole assembly with a water density of 1 g/cm/sup 3/. A stainless steel supporting channel (0.5 cm thick) envelops each group of 4 fuel assemblies. The calculations have been done with the GAMTEC-2 computer code, for creating a 16 group cross-section library, and with KENO-IV code, for determining the multiplication factor.

48528 (INIS-BR—1147-Vol.1, pp 161-166) **Strech-out for the second cycle of Angra-1.** Sakai, M. (NUCLEN, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The technique to stretch-out the cycles of comercial PWR's is being currently used all over the world due to economical aspects and energy demand. For Angra 1, a simple stretch-out strategy is suggested for the second cycle which will not introduce any change in the technical specifications of the plant. This paper presents the results of the stretch-out neutronic calculations and the consequences on the next reload design.

48529 (INIS-BR—1147-Vol.1, pp 167-175) **Comparison between theoretical values foreseen and measured during the commissioning of second cycle of Angra-1.** Angelkorte, G.; Dias, A.M.; Sakai, M. (NUCLEN, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The purpose of this paper is to present the most important results of the comparison of the data measured during the start-up tests for the second cycle of Angra 1 with the calculated values for this cycle. This short comparison considered the following quantities: Critical boron concentration, Control rod worths, Isothermal temperature coefficient, Reaction rates of the incore detector system. The calculated results showed good agreement with the measured ones remaining within the acceptation criteria limits, confirming the fuel management calculations for the second cycle, namely that for the reload scheme obtained, the core is capable of operating at nominal power safety and without restrictions.

48530 (INIS-BR—1147-Vol.1, pp 265-272) **Determination of Angra 1 excore power range detectors response in function of the axial asymmetry of neutron flux.** Borges, J.B. (FURNAS, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The relationship between Angra 1 excore power range detectors response and the axial flux offset measured by incore movable detectors mappings was determined during plant operation at 75 % power (1400 MW/sub th,'). This relationship was utilized to generate the f({Delta}q) function, a input to the Reactor Protection System to protect against adverse axial power shapes and to mantain the fuel rods integrity. (autor).

48531 (INIS-BR—1147-Vol.1, pp 297-306) **Use of the FRAPCON-1 computer code for specifying UO/sub 2/ pellet design parameters of PWRs.** Marra Neto, A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

UO/sub 2/ pellet design parameters are analysed to verify their influence in the fuel basic properties and in its performance under irradiatton in pressurized water reactors. Three groups of parameters are discussed: 1) content of fissionable and impurity materials; 2) stoichiometry; 3) density, pore morphology, and microstructure. A methodology is applied with the fuel performance program FRAPCON-1 to specify these parameters.

48532 (INIS-BR—1147-Vol.1, pp 315-324) **Geometric dimensioning of UO/sub 2/ pellets for PWR.** Teixeira e Silva, A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The finite element structural program SAP-IV is used to calculate UO/sub 2/ pellet strains developed under thermal gradients in pressurized water reactors. The applied procedure allows to analyse the influence of various aspects of pellet geometry on cladding strains and can be utilized for the dimensioning of UO/sub 2/ pellets. Pellets purchased with flat ends, with dishes pressed into both ends, shouders, and a 45-deg edge chamfer are analysed. The analyse results are compared with experimental data.(autor).

48533 (INIS-BR—1147-Vol.1, pp 345-354) **Methodology of fuel rod design for pressurized light water reactors.** Teixeira e Silva, A.; Esteves, A.M. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The fuel performance program FRAPCON-1 and the structural finite element program SAP-IV are applied in a pressurized water reactor fuel rod design methodology. The applied calculation procedure allows to dimension the fuel rod components and characterize its internal pressure.

48534 (INIS-BR—1147-Vol.1, pp 363-371) **Materials concept for systems using seawater as coolant.** Volta, A.R.; Lobo, C.G.; Aboud, J.E. (NUCLEN, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The systems designed for seawater applications for Angra 2 and 3 project are described. The behaviour of the several materials related to the application, security and operating conditions of the systems are discussed and the specified materials for the important systems based on the material concepts are pointed out.

48535 (INIS-BR—1147-Vol.1, pp 375-383) **Evaluation of thermo-hydraulic parameter statistical treatment for raising protection limiting curves of Angra-1 reactor.** Pontedeiro, A.C.; Galetti, M.R.S. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The application to CNEN's approval of a new calculation procedure to DNBR determination, led to the necessity of an independent estimation by this regulatory body. In this paper, using the new procedure "Improved Thermal Design Procedure - LTDP"/sup 1/, the DNBR limit value to Angra 1 NPP was obtained, taking into account the statistical uncertainty association with core

thermal-hydraulic parameters. The original plant design basis was kept without changes/sup 2/. With the widening of the calculated thermal limits, that was obtained by the ITDP, new reactor protection limit curves to the overtemperature OT{Delta}T System was established in order to prevent the core against DNB. A new operation region was bounded and the new OT{Delta}T system setpoints were calculated. The DNBR marginal gain was estimated by the simulation of the limiting accidents concerning DNB.

48536 (INIS-BR—1147-Vol.1, pp 385-394) **Fourth and last stage of project for the implementation of the asymmetric cooling loop modeling ALMOD3 code.** Dominguez, L. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A two loop simulation capability was developed to the ALMOD 3W2 code through modelling the steam header line connecting the secondary side of steam generators. A brief description of the model is presented and twotest casess are shown. Basic code changes are addressed.

48537 (INIS-BR—1147-Vol.1, pp 415-424) **Simplified model of a PWR primary coolant circuit.** Souza, A.L. de; Faya, A.J.G. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The computer program RENUR was developed to perform a very simplified simulation of a typical PWR primary circuit. The program has mathematical models for the thermal-hydraulics of the reactor core and the pressurizer, the rest of the circuit being treated as a single volume. Heat conduction in the fuel rod is analysed by a nodal model. Average and hot channels are treated so that the bulk response of the core and DNBR can be evaluated. A Homogeneous model is employed in the pressurizer. Results are presented for a steady-state situation as well as for a loss of load transient. Agreement with the results of more elaborate computer codes is good with substantial reduction in computer costs.

48538 (INIS-BR—1147-Vol.1, pp 425-436) **Application of perturbation theory (differential formalism) for sensitivity analysis in steam generators of PWR nuclear power plants.** Sanders, R.M.G.; Lima, F.R.A.; Alvim, A.C.M. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Posgraduacao de Engenharia). 1988. (In Portuguese). NTIS (US Sales Only), PC A2/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

This work presents an application of the differential approach to perturbation theory to a homogeneous model of a PWR steam generator under steady-state conditions. Program PERGEVAP was built from the code GEVAP, developed by SOUZA, and allows sensitivity calculations of linear (like the average primary loop temperature) and nonlinear (like the average heat flux) functionals to variations in thermohydraulics parameters, such as flow rate, enthalphy and specific heat. Results obtained with this approach are compared to direct calculations using GEVAP, with excellent agreement. The method has good potential to treat repeated calculations needed in the design and analysis of these equipments.

48539 (INIS-BR—1147-Vol.1, pp 437-446) **Evaluation of total pressure loss measurements during the rewetting phase.** Freitas, R.L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

These work draw a theoretical-experimental comparision from the toral pressure drop results during the reflood phase of a loss of coolant accident of a PWR. It was verify from this avaliation that the void fraction and the pressure drop models for the two-phase flow, including the subcooled boiling influence and the flow configuration, don't permit a satisfatory prediction of the experimental datas. These differences can occur from the fact that the existing model, are stablish, in your great number, for different conditions that one's for reflood.

48540 (INIS-BR—1147-Vol.1, pp 325-334) **Computer program for structural analysis of fuel elements.** Hayashi, I.M.V.; Perrotta, J.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

It's presented the code ELCOM for the matrix analysis of tubular structures coupled by rigid spacers, typical of PWR's fuel elements. The code ELCOM makes a static structural analysis, where the displacements and internal forces are obtained for each structure at the joints with the spacers, and also, the natural frequencies and vibrational modes of an equivalent integrated structure are obtained. The ELCOM result is compared to a PWR fuel element structural analysis obtained in published paper.

48541 (INIS-BR—1147-Vol.2, pp 3-12) **Civil design of the Angra Nuclear power plant, units 2 and 3.** Zuegel, L.C.; Diaz, B.E.; Cunha, M.T. (NUCLEN, Rio de Janeiro (Brazil); PROMON Engenharia S.A., Rio de Janeiro (Brazil)). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The civil design of the Angra Nuclear Power Plant, Units 2 and 3 represents an important step in the technological development of Brazil, correlated to high technology enterprises. This design was developed in Brazil, by Brazilian technicians, in a comprehensive way. In all individual and global phases of the design, a full participation of the Brazilian state and private companies has been observed. In order to proceed with the design in this way, a group of Nuclen engineers has stayed for a while in Germany, in KWU's office, for a proper training. The Brazilian design companies, on the other hand, have received a special consulting support given by engineers of German construction companies, especialized in nuclear power plant construction. For the nuclear civil design, as well as for the dynamic analyses and structural design of reinforced concrete and steel structures, the design job assumes an important position in the Brazilian technical experience. The structural design of the reinforced concrete structures of the nuclear power plant, for instance, is the largest one ever performed in Brazil in terms of difficulty, complexity and amount of man-hours expediture. A summary of the civil design steps will be described in this paper.

48542 (INIS-BR—1147-Vol.2, pp 13-22) **Detailing of Angra-2 piping arrangement.** Freire, A.C.A.C. (NUCLEN, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The analysis of the piping design executing steps on a Nuclear Power Plant together with the sources for the generated data provide the basis for understanding the parallel development of other design services and the complex assumptions made during the intermediate execution steps of the project. The detailing is presented via discussion on piping arrangement at room of safety injection pump (JND) and component cooling pumps (KAA). Executive drawings are analysed on their content and purposes. The Quality Assurance Requirements for design of Nuclear Power Plants and its implementation on Angra are presented. Finalizing documents and engineering man-hours involved are quantified.

48543 (INIS-BR—1147-Vol.2, pp 33-40) **Concept of voltage monitoring for a nuclear power plant emergency power supply system (PWR 1300 MWe).** Andrade, R.B. de. (NUCLEN, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Voltage monitoring concept for a Nuclear Power Plant Emergency Power Supply Systems (PWR 1300 MWe) is described based on the phylosophy adopted for Angra 2 and 3 NPP's. Some suggested setpoints are only guidance values and can be modified during plant commissioning for a better performance of the whole protection system.

48544 (INIS-BR—1147-Vol.3, pp 137-141) **Calculation of the external dose rate in the spent fuel pool for the case to use compact racks.** Passos, E.M. dos; Alves, A.S.M. (NUCLEN, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The possible introduction of compact racks in the spent fuel pool of the Angra 1 Nuclear Power Plant largely inreases its storage capacity, but originates an increase of the gamma radiation sources. The precise evaluation of the effects of the adoption of this option on the external gamma dose rates and also on the thickness of the concrete shielding requires the utilization of sofisticated computer codes (QAD, ANISN), which allow the calculation of the gamma dose rates through thick shielding walls. This paper describes the utilized methodology for the calculation of the modified pool shieldings, showing the obtained results for the Angra 1 NPP case. The gamma dose rate was calculated with the point Kernel model, first analytically, and later through utilization of the tridimensional multigroup QAD computer code.

48545 (INIS-BR—1147-Vol.3, pp 437-446) **Experience of marine macrofouling control in Angra 1 - Almirante Alvaro Alberto nuclear power plant.** Alhanati, C.E.; Costa, S.D. (FURNAS, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

One of the greatest problems at the Power Plants that use sea water in the circulating water system, is the development of fouling in its sections. In Central Nuclear Almirante Alvaro Alberto - Angra 1, this fouling is represented by barnacles. These barnacles have contributed significantly to the damaging in the condenser tubes, resulting in the changing from cooper alloy tubes to Titanium ones. To help the understanding of the development and control of fouling, some researches and observations have been made using techniques adequated to Angra 1. The low-level continuous chlorination, the water flux variation and the continuous cleaning tubes system (AMERTAP) combined and used in circulation water sistem, showed satisfactory preliminar results in fouling control.

48546 **(INIS-mf—11301) Corrosion problems for heat exchangers of pressurized water reactors.** Tugrul, B.; Yavuz, H. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy). 1985. 10p. (In Turkish). (CONF-8509456—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703919/JAW.

From 5. national congress on heat science and technology; Istanbul, Turkey (18 Sep 1985).

The corrosion event should be minimized in the heat exchangers which are used between the primary and the secondary circuits of PWR-PHWR due to radioactivity in the primary coolant.The various corrosion types and the types of heat exchangers are described with the wide-known corrosion regions in them. Corrosion defects in the heat exchangers are investigated according to all defects amount and it is evaluated types and materials of the heat exchangers as statistical values. Recently, some points are defined for the precautions of the corrosion.

48547 **(NUREG/CR—5131) Preliminary review of mass transfer and flow visualization studies and techniques relevant to the study of erosion-corrosion of reactor piping systems.** Kuzay, T.M.; Halle, H.J.; Kasza, K.E. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering Technology; Argonne National Lab., IL (USA)). Jun 1988. Contract W-31109-ENG-38. 28p. (ANL—88-20). NTIS, PC A03/MF A01 - GPO. Order Number TI88014910/JAW.

This report provides some background information on the failed piping at the Surry-2 reactor; a summary of pertinent literature on mass transfer in related geometries; and a description of methodologies for visualization and erosion rate measurements in laboratory model studies that can provide greater insight into the role of flow geometry in erosion-corrosion. 18 refs., 9 figs., 1 tab.

48548 **(NUREG/CR—5144) Acoustic emission system calibration at Watts Bar Unit 1 nuclear reactor.** Hutton, P.H.; Friesel, M.A.; Dawson, J.F.; Harris, J.C. (Nuclear Regulatory Commission, Washington, DC (USA); Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 32p. (PNL—6549). NTIS, PC A03/MF A01 - GPO. Order Number TI88015588/JAW.

An acoustic emission system has been installed on TVA's Watts Bar Unit 1 reactor to monitor selected areas of the pressure boundary during hydrostatic testing, hot functional testing, and ultimately, during reactor startup and operation. This is a part of a cooperative effort between TVA and NRC Research to test and demonstrate AE technology. This technology has been developed under an NRC Research program to validate the application of AE techniques for continuous, on-line monitoring of reactor pressure boundaries to detect cracking. This report discusses the performance of and results from a special calibration test of the AE system using simulated AE signals to evaluate the accuracy of signal source location by the system.

48549 **(NUREG/CR—5149) Erosion-corrosion of PWR feedwater piping survey of experience, design, water chemistry, and materials: Final report.** Jonas, O. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Jonas, Inc., Wilmington, DE (USA)). Mar 1988. Contract W-31109-ENG-38. 98p. (ANL—88-23). NTIS, PC A05 - GPO. Order Number TI88014655/JAW.

This report represents the results of a survey of 26 PWRs in the US. The survey determined the frequency of erosion-corrosion in these reactors and the corresponding design and operating parameters of interest, including (1) feedwater velocities, temperatures, and pressures, (2) water chemistry characteristics, and (3) the materials of construction. These data are reviewed in terms of the known effects of these parameters on erosion-corrosion and used to develop recommendations for further work.

48550 **(NUREG/CR—5156) Review of erosion-corrosion in single-phase flows.** Cragnolino, G.; Czajkowski, C.; Shack, W.J. (Nuclear Regulatory Commission, Washington, DC (USA); Argonne National Lab., IL (USA)). Apr 1988. Contract W-31109-ENG-38. 107p. (ANL—88-25). NTIS, PC A06/MF A01 - GPO. Order Number TI88015791/JAW.

This report contains two literature reviews (prepared by Brookhaven National Laboratory and Argonne National Laboratory, respectively) on the available data and current mechanistic understanding of erosion-corrosion, and a failure analysis (prepared by Brookhaven National Laboratory) of a tee-elbow joint from the Surry Unit 2 reactor that failed by erosion-corrosion in December 1986. It also includes suggestions for additional research that should be performed by the USNRC to increase the capability to rank plants and/or locations within plants in terms of susceptibility to erosion-corrosion and to ensure that proposed inspection and mitigation programs are soundly based.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 48654

48551 **(BMU—1988-176) Investigations on crack growth in heat exchanging components with working temperatures above 800/sup 0/C - a contribution to a HTR safety concept. Final report.** Roedig, M.; Kwasny, R.; Pfaffelhuber, M.; Schubert, F.; Nickel, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe; Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.)). 1988. 191p. (In German). (Juel-Spez—408). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

Experiments on the transferability of fracture mechanics data to thick walled tubes have been performed with the materials X10NiCrAlTi 32 20 (Alloy 800 H) and NiCr 22 Co 12 Mo (Inconel 617). The fatigue crack growth is well described by the linear elastic ΔK/sub I/-concept up to the highest testing temperatures (900/sup 0/C). For the description of the creep crack propagation in tubes the parameter C/sup */ seems to be suitable.

48552 **(INIS-mf—11792) AVR reactor. 2. quarterly report 1987. April 1, 1987 - June 30, 1987.** (Arbeitsgemeinschaft Versuchs-Reaktor G.m.b.H., Duesseldorf (Germany, F.R.)). 1987. 52p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754653/JAW.

Due to the scheduled long shut-off period, the AVR reactor has been operating for only a few weeks in the second quarter of 1987. The following operating data have been achieved in the reporting period: - operating time ratio 27.06% - plant load factor 14.28% - rated output factor el. 4678.4 MW hours. On April 26, 1987 the power plant has been shut-down for the major maintenance phase 1987 (ASP 3-87). Recurrent inspection work had to be done on about 300 vessels, including the reactor vessel. Preparatory mounting work for planned experiments has been done. The shutdown phase has been continued into the 3rd quarter 1987. The report lists the main recurrent inspection activities.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 48571, 48600, 48655, 50268

48553 (INIS-BR—1147-Vol.2, pp 67-76) **Binary breeder reactor with annular core.** Nascimento, J.A. do; Ishiguro, Y. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Characteristics of a 1200 MWe binary breeder reactor with annular core fueled with metallic /sup 233/U- /sup 238/U-Zr, Pu-/sup 238/U-Zr and Th in the blankets have been analyzed. The Doppler effect is small as expected in a metal fueled fast reactor. The sodium void reactivity is, in general, smaller than in homogeneous fast reactors fueled with metallic fuel and with 1 m core height. The worths of available control is high and there is a large shutdown margin throughout the operational cycle. There are flexibility in blankets fueling in the two cycles, uranium and thorium, with doubling times of about 20 years.

48554 (INIS-BR—1147-Vol.2, pp 77-84) **Development of computer program for calculating fires from sodium.** Goncalves, A.C.; Torres, A.R.; Correa, S.M.; Messere e Castro, P. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

It is showed in this paper a computational method of to predict fires from sodium lenks at high temperatures. The program was developed to attend the needs of safety at the actual stage of the Rapid Reactor Program of IEN/CNEN. The objectives are to calculate the sodium pool temperature from a lenkage, the combustion time and aerosol concentration at the inner atmosphere of the "Sodium Loop Facility", in case of hipothetical accident with sodium fire. Is also presented the combustion kinetics and the methods to calculate the amount of heat generated, the amount of heat lost and the aerosol concentration. The results calculated by the computer code are compared with the values obtained from fires experiences, that were simulations in scale of 1:1000 of the facilities.

48555 **(NUREG/CR—4625) The postirradiation examination of the DC [Dry Capsule] melt dynamics experiments.** Fryer, C.P.; Hitchcock, J.T. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Accident Analysis; Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 53p. (SAND—86-1102). NTIS, PC A04/MF A01 - GPO. Order Number TI88014785/JAW.

The Dry Capsule experiment series investigates the coolability of dry fast reactor core debris through nuclear heating of actual reactor materials in order to obtain the thermal properties of dry debris, the nature of the transition from a debris bed to a molten pool, and the thermal and kinetic behavior of molten pools. The purpose is to develop a data base in support of model development. The work is jointly sponsored by the US Nuclear Regulatory Commission (USNRC), the Power Reactor and Nuclear Fuel Development Corporation (PNC, Japan), and Joint Research Centre, Ispra (EURATOM). This report provides a brief description of the two experiments in the Dry Capsule series and presents the results of the postirradiation examination. These tests investigated dry debris beds ({approximately}2kg) composed of pure UO_2 and mixed UO_2 and stainless steel. The beds were taken into melt to observe the growth of a molten pool in the UO_2 bed and the agglomeration and migration of steel in a composite bed. The peak measured temperature in the UO_2 bed was above 3100{degree}C. Approximately 50 percent of the urania formed a molten pool. Surrounding the molten pool and an overlying void was a high density urania crust. Lenticular pore formation and migration caused by urania vapor transport in the strong thermal gradient were seen in the urania crust. In the mixed UO_2 and steel bed, the peak measured temperature was 2600{degree} C. All of the steel had been molten. Steel and urania migration were observed; both were thought to be caused by vapor transport mechanisms.

48556 **(WHC-SA—0013) Fuel failure monitoring at the Fast Flux Test Facility.** Bechtold, R.A. (Westinghouse Hanford Co., Richland, WA (USA)). Jul 1987. Contract AC06-87RL10930. 9p. (CONF-870822—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013665/JAW.

From American Institute of Chemical Engineers summer national meeting; Minneapolis, MN, USA (16 Aug 1987).

Early detection and characterization of breached test material specimens and experimental fuel pins in the Fast Flux Test Facility (FFTF) are accomplished by monitoring noble gas radioisotopes. Since reactor operation began, over 100 individual creep capsules, one driver fuel pin, and nine test assembly breaches have been successfully identified. An overview of the monitoring system as well as operational experience with failure detection and identification is described. 6 refs.

48557 **(WHC-SA—0057) Fast breeder reactors for energy security.** Jacobi, W.M. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1987. Contract AC06-87RL10930. 8p. (CONF-870917—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014019/JAW.

From ANS/ENS international conference on fast breeder reactor systems: experience gained and path to economical power generation; Richland, WA, USA (13 Sep 1987).

Although the time scale for the development of new energy sources has been lengthened, the need for economic Liquid Metal Breeder Reactors remains a key element in our economic future. In the United States the development of Liquid Metal Reactors is directed toward reduction of fuel cycle and plant capital costs to pro-

mote early deployment as an economically competitive alternative to Light Water Reactors. Reactor plant improvements have been made which focus on inherent reactor safety, plant modularity, and prepackaging of plant components. Alternate fuel systems and dramatic extension of fuel lifetimes offer potential for major cost improvements. The swiftness of changes in economic conditions require that we immediately address LMFBR development with focused resources and teamwork. 6 refs., 10 figs., 1 tab.

48558 (WHC-SA—0092) FFTF/IEM [Fast Flux Test Facility/Interim Examination and Maintenance] Cell fuel pin removal equipment. Greenwell, R.K. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1987. Contract AC06-87RL10930. 10p. (CONF-8711195—2). NTIS, PC A02. Order Number DE88013586/JAW.

From American Nuclear Society winter meeting; Los Angeles, CA, USA (15 Nov 1987).

Disassembly of irradiated fuel assemblies at the Fast Flux Test Facility (FFTF) Interim Examination and Maintenance (IEM) Cell involves removing fuel pins from the pin bundle by sliding the pins from parallel attachment rails after the outer fuel assembly duct has been removed. Special equipment has been developed for the remote removal of fuel pins that significantly reduces pin removal time and provides better control than the previous method of direct removal with a masterslave manipulator (MSM). Remote installation and adaptability to various fuel assembly configurations in the design of this equipment. 7 figs.

48559 (WHC-SA—0131) Transient testing of long-lifetime mixed-oxide liquid metal reactor fuel. Alderman, C.J.; Pitner, A.L. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 13p. (CONF-880601—39). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013584/JAW.

From American Nuclear Society annual meeting; San Diego, CA, USA (12 Jun 1988).

The performance of large diameter, mixed oxide, HT9 clad fuel pins was investigated in a series of three experiments. Irradiated fuel pins of advanced design were subjected to the thermal equivalent of 5{cents}/s and 1{dollar←sign}/s reactivity insertion overpower transients. All pins tested exhibited a margin-to-failure beyond those of mixed oxide fuel pins previously tested at these transient rates demonstrating the superiority of the large diameter HT9 clad fuel pin. Significant molten fuel motion out of the fuel column region occurred in all pins tested, supporting the inherent safety aspect of oxide fuel during severe overpower transients by the movement of fuel from high-worth regions to low-worth regions.

48560 (WHC-SA—0179) The role of LMRs [Liquid Metal Cooled Reactor] for next generation power reactors: A strategy for sensible change. Omberg, R.P.; Lucoff, D.M.; Padilla, A.; Waltar, A.E. (Westinghouse Hanford Co., Richland, WA (USA)). Apr 1988. Contract AC06-87RL10930. 7p. (CONF-880506—22). NTIS, PC A02. Order Number DE88013671/JAW.

From Safety of next generation power reactors; Seattle, WA, USA (1 May 1988).

Will there be a next nuclear era and, if so, what conditions will have to be met to encourage utilities to place new nuclear orders? Whereas utilities were once isolated businesses, they now find themselves in a socio/political/economic squeeze between changing national energy policies, continually evolving public opinion, and cyclic economic conditions. As a result, the technical design requirements for an electrical generating system qualified to meet these changing demands continue to evolve. The purposes of the present paper are to explore these changing pressure points and to assess whether the Liquid Metal Cooled Reactor concept has sufficient versatility to allow this type of reactor to be effectively included in utility planning. 3 refs., 5 figs., 2 tabs.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 48623, 48636

48561 (EGG-M—88088) Multimegawatt power sources for commercial space operations. Dearien, J.A.; Martinell, J.S. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 8p. (CONF-8804176—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015119/JAW.

From 25. space congress; Cocoa Beach, FL, USA (26 Apr 1988).

There is a great deal of interest in commercial operation in space today, but very little consideration of where the power to run such an operation is to come from. For any commercial operation in space, the power source, especially those involving kilowatts and megawatts of power, must be considered at the very onset of the venture. The Multimegawatt Space Reactor Program at the Idaho National Engineering Laboratory is working this problem in conjunction with the development of Strategic Defense Initiative needs. The same type of up-front power development program needs to be considered in all discussions associated with commercial development in space. A system developed for a commercial operation in space will most likely be a hybrid system utilizing both electrical and thermal energy. Even if the commercial process consists totally of high power thermal energy usage, there will be a certain amount of electricity required for controls, mass transport, environmental control (if manned), and communications. The optimum system will thus require a great deal of planning and coordination with the development of the commercial process. 2 refs., 4 figs.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 48524, 48560, 48615, 48616, 48640, 48641, 48735, 48736

48562 (BMU—1987-175) Aims and procedures used for the evaluation of research results in the field of nuclear safety with regard to the application of the Atomic Energy Law. Vol. 2. Baumgaertel, K. (comp.). (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1987. 678p. (In German). (GRS-A—1349). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

The content of this report is a collection of research projects and investigations in the field of nuclear safety evaluated in 1985 and 1986. In addition the report gives an overview on objectives and procedures used for the evaluation. The purpose of this project, being executed for the Federal Ministry for the Environment, Natural Conservation and Nuclear Safety of the German Federal Republic is to inform all parties involved in the licensing procedure as well as the consulting councils on the newest nuclear safety research results and the status of their verification in a precise short manner. In addition experts opinions are given with regard to the relevance of these research results to nuclear rules and guidelines as well as to the execution of the Atomic Law. The informations are given by precise and short evaluations of final research reports or technical reports. These evaluations are executed by specialists who are acquainted with the technical aspects of the licensing procedure of nuclear power plants in the German Federal Republic.

48563 **(EPRI-NP—5989) Effects of control-room lighting on operator performance: A pilot empirical study: Final report.** Horst, R.L.; Silverman, E.B.; Mahaffey, D.L.; Raver, J.A.; Webster, K.K. (Electric Power Research Inst., Palo Alto, CA (USA); Advanced Resource Development Corp., Columbia, MD (USA)). Aug 1988. 58p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016216/JAW.

The illumination in the control rooms of many operating nuclear plants falls below the levels specified in the NUREG-0700 guidelines. However, a close examination of the research literature upon which these guidelines were based revealed that the underlying human performance data were acquired with laboratory conditions and with tasks very different from those typically found in control rooms. There were three objectives of the present study: to develop an empirical method for investigating performance, under a wide range of illumination levels, with tasks selected to sample the functions and abilities that are representative of process control operations; to gather pilot empirical data regarding the levels of illumination sufficient for performing tasks analogous to those performed in control rooms; and to make recommendations for more extensive future studies of lighting effects on operator performance. Results are presented and discussed. 23 refs., 5 figs.

48564 (INIS-BR—1147-Vol.2, pp 131-140) **Legal aspects of radiactive installations.** Malheiros, T.M.M.; Knoefell, T.M.J. (Associacao Brasileira de Direito Nuclear, Rio de Janeiro). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The goal of this paper is to discuss the main legal aspects related to the application of ionizing radiation in the industry, medicine, agriculture, scientific activities to envisage from the in force legislation the competence and responsibility for the control of radiation facilities comprising regulation, licensing and inspection. Legislation does not embrace all the aspects related to radiation facilities regarding to the specific provisions on civil liability concerning damages caused by non nuclear radiological accidents. The law nr.6.453 is applied only to nuclear accident, as defined in its rules.

48565 **(NUREG—0750-Vol.27-No.5) Nuclear Regulatory Commission issuances.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services). May 1988. 149p. NTIS, PC A07/MF A01 - GPO. Order Number TI88014610/JAW.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

48566 **(NUREG—0936-Vol.7-No.1) NRC Regulatory Agenda: Quarterly report, January--March 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services). Jul 1988. 112p. NTIS, PC A06/MF A01 - GPO. Order Number TI88014123/JAW.

The Regulatory Agenda is a quarterly compilation of all rules on which the NRC has proposed, or is considering action as well as those on which it has recently completed action, and all petitions for rulemaking which have been received and are pending disposition by the Commission.

48567 **(NUREG/CR—0672-Add.3) Technology, safety and costs of decommissioning a refernce boiling water reactor power station: Technical support for decommissioning matters related to preparation of the final decommissioning rule.** Konzek, G.J.; Smith, R.I. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 66p. NTIS, PC A04/MF A01 - GPO. Order Number TI88014924/JAW.

Preparation of the final Decommissioning Rule by the Nuclear Regulatory Commission (NRC) staff has been assisted by Pacific Northwest Laboratory (PNL) staff familiar with decommissioning matters. These efforts have included updating previous cost estimates developed during the series of studies of conceptually decommissioning reference licensed nuclear facilities for inclusion in the Final Generic Environmental Impact Statement (FGEIS) on decommissioning; documenting the cost updates; evaluating the cost and dose impacts of post-TMI-2 backfits on decommissioning; developing a revised scaling formula for estimating decommissioning costs for reactor plants different in size from the reference boiling water reactor (BWR) described in the earlier study; and defining a formula for adjusting current cost estimates to reflect future escalation in labor, materials, and waste disposal costs. This report presents the results of recent PNL studies to provide supporting information in three areas concerning decommissioning of the reference BWR: updating the previous cost estimates to January 1986 dollars; assessing the cost and dose impacts of post-TMI-2 backfits; and developing a scaling formula for plants different in size than the reference plant and an escalation formula for adjusting current cost estimates for future escalation.

2108 Economics

REFER ALSO TO CITATION(S) 48560, 48641

48568 (INIS-BR—1147-Vol.2, pp 59-66) **Reorientation of the Brazilian nuclear program and the function of technique community.** Ishiguro, Y.; Nascimento, J.A. do. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Once the available hydroelectric potentials have been developed, probably in 30 years, Brazil will need an alternative source for electric generation. Fossil fuels are limited in quantity and present serious health and environmental problems. Other sources such as solar and fusion energies are yet to be proved technologically and socio-economically and cannot be relied on in a rational planning for the future. Nuclear energy generated in Liquid metal fast breeder reactors is technologically proven, present minimum adverse effects, is economically competitive today, and has the capacity to supply all the electric power for centuries based on domestic resources. The nuclear community has the responsability to formulate and execute a program for technology development as soon as possible and to communicate to the people the necessity and merits of nuclear energy.

48569 **(INIS-mf—11292) Development of nuclear energy and Turkey.** Aybers, N.; Yavuz, H. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy). 1986. 1p. (CONF-8611267—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703910/JAW.

From 4. Turkish energy congress; Izmir, Turkey (12 Nov 1986).

Will be published.

22 NUCLEAR REACTOR TECHNOLOGY

REFER ALSO TO CITATION(S) 48181

48570 **(INIS-BR—1147-Vol.1) Proceedings of the 2. General Congress of Nuclear Energy. Vol. 1.** (Associacao Brasileira de Energia Nuclear, Rio de Janeiro). 1988. 487p. (In Portuguese). (CONF-880440—). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW.

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The papers arranged in the following fields: safety analysis and licensing; reactor physics; nuclear physics; reactor operation; reactor engineering and nuclear fuel analysis; science and technology of materials; and thermohydraulic, are presented. (M.C.K.).

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 48592, 48599, 48627, 50001

48571 (INIS-BR—1147-Vol.1, pp 139-147) **Suboptimum determination of homogeneization factors in simulating the unitary distribution of azimuthal neutron flux in the annular control region.** Jachic, J. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The unitary distribution of the azimuthal neutronic flux in the annular control region for a low power fast reactor model is simulated in slab geometry and retangular mesh by a unidimensional calculation under periodic boundary conditions. The results show the viability of the method as well as its applications in the tridimensional neutronic state synthesis.

48572 (INIS-BR—1147-Vol.1, pp 177-186) **BCG: a computer code for calculating neutron spectra and criticality in cells of fast reactors.** Leite, S.B.; Caldeira, A.D.; Garcia, R.D.M. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The BCG code for determining the space and energy neutron flux distribution and criticality of fast reactor cylindrical cells is discussed. The code solves the unidimensional neutron transport equation together with interface current relations at each energy point in an unionized energy grid prepared for the cell and at an arbitrary number of spatial zones. While the spatial resolution is user specified, the energy dependence of the flux distribution is resolved according to the degree of variation in the reconstructed total microscopic cross sections of the atomic species in the cell. Results for a simplified fuel cell illustrate the high resolution and accuracy that can be obtained with the code.

48573 (INIS-BR—1147-Vol.1, pp 187-198) **Altenative pseudo-harmonics method: application to two-dimensional reactor calculations.** Abreu, M.P. de; Alvim, A.C.M.; Thome, Z.D. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

An alternative to the pseudo-harmonics method of computing two-dimensional perturbed states of nuclear reactors is presented, together with some results of neutron flux reconstruction and eigenvalue calculation. These results refer to intense localized perturbations, where a significant imbalance between production and destruction rates exists. Previous methods have presented convergence problems. The alternative described was able to overcome these problems and is thus considered to be very promising for two-dimensional calculations.

48574 (INIS-BR—1147-Vol.1, pp 447-458) **Application of the heuristically based GPT theory to termohydraulic problems.** Alvim, A.C.M.; Andrade Lima, F.R. de; Gandini, A. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia; Pernambuco Univ., Recife (Brazil). Dept. de Energia Nuclear; ENEA, Rome (Italy)). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Application of heuristically based generalized perturbation theory (GPT) to the thermohydraulic (generally nonlinear) field is here illustrated. After a short description of the general methodology, the (linear) equations governing the importance function relevant to a generic multichannel problem are derived, within the physical model adopted in the COBRA IV-I Code. These equations are put in a form which should benefit of the calculational scheme of the original COBRA Code in the sense that only minor changes of it (mostly implying physical constants and source terms redefinitions) should be necessary for their solutions.

48575 **(LA-UR—88-2129) The impact of ENDF-6 on cross section processing codes.** MacFarlane, R.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-880911—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014411/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

The new ENDF-6 format for evaluated nuclear data provides some important new capabilities, but it was designed to keep many features of the earlier formats. As a result, codes that do not need the new capabilities can be updated with a few key modifications. Other codes will require more extensive changes, but they will become more useful. Some of the new capabilities included in the ENDF-6 format are: an extended and more systematic procedure for naming reactions, including complex and charged-particle reactions; new resonance representations for Reich-Moore and R-Matrix parameters; a capability of giving energy-angle distributions for all the products of a nuclear reaction, including the recoil nucleus; and incident charged-particle data including large-angle Coulomb scattering. The effects of these changes are discussed for three classes of processing code applications: fission reactor codes, fusion neutronics codes, and charged-particle codes. 12 refs.

48576 **(SAND—88-0850C) Progress in NODAL transport methods.** Badruzzaman, A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 18p. (CONF-880906—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012416/JAW.

From 7. international conference on radiation shielding; Bournemouth, UK (12 Sep 1988).

The state-of-the-art methods in nodal transport are discussed. Two major classes of these methods have been developed in multidimensional cartesian geometry. The first can be viewed as a set of general difference schemes of the discrete ordinates (S/sub N/) transport equation. In the second, the angular dependence of the cell-edge fluxes is treated by interface-current techniques of varying degrees of sophistication. Both methods are reviewed. Development of appropriate acceleration schemes and the recent extension of the nodal S/sub N/ procedures to time-dependent and cylindrical geometry are discussed briefly. 54 refs., 1 fig. 1 tab.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 48509, 48583, 48657, 48658, 48659, 48660, 48661, 48662, 48663, 49250

48577 **(EGG-M—31587) Nuclear plant aging research on the high pressure injection system.** Meyer, L.C. (EG and G Idaho, Inc., Idaho Falls (USA)). [1988]. Contract AC07-76ID01570. 7p. (CONF-880748—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015137/JAW.

From American Nuclear Society topical meeting on nuclear power plant life extension; Snowbird, UT, USA (31 Jul 1988).

This paper presents the results of a review of light water reactor High Pressure Injection System (HPIS) operating experiences reported in the Nuclear Power Experience Data Base, Licensee Event Reports, Nuclear Plant Reliability Data System, and plant records. The purpose of the review is to evaluate the potential significance of aging as a contributor to degradation of the HPIS. Tables are presented that show the percentage of events for HPIS classified by cause, component, and subcomponents for pressurized water reactors. A representative Babcock and Wilcox plant was selected for a detailed study. The US Nuclear Regulatory Commission's Nuclear Plant Aging Research guidelines were followed in performing the detailed study that identifies components susceptible to aging, stressors, degradation mechanisms, and failure modes for the HPIS. 3 refs., 2 figs., 6 tabs.

48578 **(EPRI-NP—5959-SR) Crack-opening area calculations for circumferential through-wall pipe cracks.** Kishida, K.; Zahoor, A. (Electric Power Research Inst., Palo Alto, CA (USA); Ishikawajima-Harima Heavy Industries Ltd., Yokohama (Japan); NOVETECH Corp., Rockville, MD (USA)). Aug 1988. 127p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015788/JAW.

This report describes the estimation schemes for crack opening displacement (COD) of a circumferential through-wall crack, then compares the COD predictions with pipe experimental data. Accurate predictions for COD are required to reliably predict the leak rate through a crack in leak-before-break applications.

48579 (INIS-BR—1147-Vol.1, pp 405-413) **Simulation of pump shutdown test in the experimental water circuit using the RELAP4/MOD5 code.** Borges, R.C.; Freitas, R.L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Since is important the theoretical-experimental comparison to evaluate the computer codes, these paper presents the simulation with RELAP4/MOD5 Code of a loss of power energy in the pump of the "Circuito Experimental de Agua-CEA". From the results attained, the existing models in the Code showed to be very satisfatory quantitative and qualitative behavior of the attained experimental results.

48580 (INIS-BR—1147-Vol.2, pp 41-55) **Heat exchangers cooled by seawater, for nuclear power plants - Design and conservation techniques.** Volta, A.R.; Siqueira, L.C.F.; Maretti, M.E. (NUCLEN, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Heat exchangers for sea water systems are discussed in terms of design and manufacturing processes. The behaviour of materials in contact with sea water medium is discussed and the concepts of materials are presented. Cleaning and conservation technics are presented as important recommendations to improve the reliability of the heat exchangers during operation.

48581 (INIS-BR—1147-Vol.2, pp 23-31) **Data processing systems for planning and accompanying the erection of pipes and supports in nuclear power plants.** Abud, P.R.; Spiegelberg, N. (NUCLEN, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The piping, for a Nuclear Power Plant Station, represents around 60% of all Mechanical and Electrical erection costs. Considering the high complexity of piping design, the 55000 erection documents produced by this design, as well as the several revisions of these documents, it has been of utmost importance the development of proper follow-up instruments to allow the management of interface among, quality assurance erection and documentation. Due to the volume of the data base information, their updating criteria, analytic functions and request frequency, the option was the development of Data Processing Systems, aiming at a greater reliability, integrity and quicker access to the information. The purpose of this work is to present the basic concepts and products of these systems.

48582 **(NUREG/CR—5012) Similarity principles for equipment qualification by experience.** Kana, D.D.; Pomerening, D.J. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; EG and G Idaho, Inc., Idaho Falls (USA); Southwest Research Inst., San Antonio, TX (USA)). Jul 1988. Contract AC07-76ID01570. 145p. (EGG—2521). NTIS, PC A07/MF A01 - GPO. Order Number TI88014922/JAW.

The purpose of this report is to present a basis from which the similarity principals originate, more specific similarity methodology, practical examples of the use of that methodology in qualification by experience, and a relationship for the methodology to safety margin applications.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 48559, 49129

48583 **(DOE/ID/12651—2-Vol.5) Fuel Rod Consolidation Project: Phase 2, Final report: Volume 5, Operations and maintenance manual.** (NUS Corp., Gaithersburg, MD (USA)). 12 Jan 1988. Contract AC07-86ID12651. 277p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE88015040/JAW.

The purpose of this manual is to describe the function, installation, operation and maintenance of the Fuel Rod Consolidation System. This Document is preliminary and must be updated to incorporate any modifications to the mechanical and electrical systems that are performed during construction. Any changes and specific references related to the software requirements will be provided as the software is developed in Phase III. Setpoints related to equipment positions as a function of resolver and position transducer readings will also be provided in Phase III. References such as vendor supplied Operating and Maintenance Manuals for vendor components and assemblies are not available until a receipt of a purchase order. These references will become an integral part of this manual during the construction phase.

48584 (INIS-BR—1147-Vol.2, pp 349-356) **Development of (U,Gd)O/sub 2/ pellet fabrication process.** Riella, H.G.; Menezes, R. de; Souza, J.A.B. de; Nogueira, R.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The addition of Gd/sub 2/O/sub 3/ (0,5 - 3,5 wt%) to UO/sub 2/ powder has been studied by monitoring variations in the density and microstructure of sintered (U,Gd)O/sub 2/ pellets. These pellets were obtained by uniaxial compaction in a floating die followed by sintering at 1650 +- 10/sup 0/C for 3 hours in hydrogen atmosphere.

2204 Control Systems

REFER ALSO TO CITATION(S) 48525, 48571, 50328

48585 **(CONF-880850—8) An application of object-oriented programming to process simulation.** Robinson, J.T.; Otaduy, P.J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015560/JAW.

From American Institute of Chemical Engineers summer national meeting; Denver, CO, USA (21 Aug 1988).

This paper discusses the application of object-oriented programming to dynamic simulation of continuous processes. Processes may be modeled using this technique as a collection of objects which communicate with each other via message passing. Arriving messages invoke methods that describe the state and/or dynamic behavior of the receiving object. The objects fall into four broad categories actual plant components such as pumps, pipes, and tanks, abstract objects such as heat sources and conductors, plant systems such as flow loops, and simulation control and interface objects. This technique differs from traditional approaches to process simulation, in which the process is represented by either a system of differential equations or a block diagram of mathematical operators. The use of objects minimizes the representational gap between the model and actual process. From the users point of view, construction of a simulation model becomes equivalent to drawing a plant schematic. As an example application, a package developed for the simulation of nuclear power plants is described. The package allows users to build simulation models by selecting iconic repre-

sentations of plant components from a menu and connecting them with a mouse. Objects for generating a mathematical model of the system and for controlling the simulation are automatically generated, freeing the user to concentrate on describing his process. This example illustrates the use of object-oriented programming to create a highly interactive and automated simulation environment. 2 figs

48586 **(CONF-880911—5) Optimal filtering, parameter tracking, and control of nonlinear nuclear reactors.** March-Leuba, C.; March-Leuba, J.; Perez, R.B. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). 24 Jun 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013238/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

This paper presents a new formulation of a class of nonlinear optimal control problems in which the system's signals are noisy and some system parameters are changing arbitrarily with time. The methodology is validated with an application to a nonlinear nuclear reactor model. A variational technique based on Pontryagin's Maximum Principle is used to filter the noisy signals, estimate the time-varying parameters, and calculate the optimal controls. The reformulation of the variational technique as an initial value problem allows this microprocessor-based algorithm to perform on-line filtering, parameter tracking, and control.

48587 **(DOE/ET/34002—3-App.) Development and demonstration of surveillance and diagnostics of rotating machinery for reducing radiation exposure to nuclear power plant personnel: Appendices: Final report.** Allen, J.W.; Bohanick, J.S. (Technology for Energy Corp., Knoxville, TN (USA)). 19 Feb 1988. Contract AC02-79ET34002. 183p. (TEC-R—87-042-A). NTIS, PC A09. Order Number DE88014715/JAW.

This program was designed to reduce radiation exposure to power plant personnel resulting from inspection, maintenance, and repair of rotating equipment. The new rotating machinery monitoring system for this program was installed at GGNS during August 1983. The following nine appendices are presented: signals monitored at GGNS; definition of characterized spectral values; instructions for alignment and balance programs; machine diagrams; FFT program; software module descriptions; sample radiation survey forms used for exposure study; radiation exposure compared to other plants; and a technical section instruction for the vibration monitoring program at GGNS.

48588 **(EGG-M—30787) Engineering simulation facilities for advanced concepts testing.** Laats, E.T.; Rittenhouse, D.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 5p. (CONF-880455—6). NTIS, PC A02. Order Number DE88015132/JAW.

From Conference of the Society of Computer Simulation; Orlando, FL, USA (18 Apr 1988).

Since the 1979 accident at the Three Mile Island, Unit 2 nuclear power plant, increasing emphasis is being placed on obtaining a higher degree of realism from plant simulators and on extending on their applicability to severe accident scenarios. Also, efforts toward reducing operator burden through improved operator procedures, man-machine interfaces and artificial intelligence "expert systems" are gaining high prominence when addressing operations related issues. The Idaho National Engineering Laboratory (INEL) is pursuing these objectives for several agencies of the US Government. An organization named the INEL Engineering Simulation Center was established in early 1988 with the goal of providing the highest fidelity simulation capability, initially for studying advance concepts and for augmenting operator training.

48589 **(EGG-M—39087) Aging considerations for PWR [pressurized water reactor] control rod drive mechanisms and reactor internals.** Ware, A.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 13p. (CONF-880748—12). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015131/JAW.

From American Nuclear Society topical meeting on nuclear power plant life extension; Snowbird, UT, USA (31 Jul 1988).

This paper describes age-related degradation mechanisms affecting life extension of pressurized water reactor control rod drive mechanisms and reactor internals. The major sources of age-related degradation for control rod drive mechanisms are thermal transients such as plant heatups and cooldowns, latchings and unlatchings, long-term aging effects on electrical insulation, and the high temperature corrosive environment. Flow induced loads, the high-temperature corrosive environment, radiation exposure, and high tensile stresses in bolts all contribute to aging related degradation of reactor internals. Another problem has been wear and fretting of instrument guide tubes. The paper also discusses age-related failures that have occurred to date in pressurized water reactors.

48590 **(INIS-BR—1147-Vol.1, pp 273-283) Maintenance of shutdown system in the reactor core to minimize the radioactive waste generation.** Ponzoni Filho, P.; Fernandes, V.B. (FURNAS, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

This paper recommends a modification on the actual strategy of going from Cold-Shutdown to Critical, that will save about 6000 liter of boric acid and 30,000 liters of demineralized water for each reactor criticalization. This strategy will reduce the radioactive waste disposal volume to only about 5% of what would be generated following the actual strategy.

48591 **(INIS-BR—1147-Vol.1, pp 307-314) Method for determining the control element drop damping system for PWR type reactors.** Trindade, C.E.; Mattos, J.R.L. de; Perrotta, J.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A method to determine the Control Assembly dampening drop system (dashpot/guide tube) was developed. It's presented a theoretical model, an experimental device and the procedure to determine this system, which is used in PWR reactors.

48592 **Measurements of /sup 10/B(n,He) reaction rates in a mockup control rod in ZPPR.** Brumbach, S.B.; Collins, P.J.; Oliver, B.M. (Argonne National Lab., Idaho Falls, ID (US)). pp 769-780 of Influence of radiation on material properties: ASTM 13th international symposium (Part II). Garner, F.A.; Henager, C.H.; Igata, N. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

Results are reported for the /sup 10/B(n,He) reaction rate measurements inside B/sub 4/C pellets contained in a mockup control rod in the Zero Power Plutonium Reactor (ZPPR). The helium accumulation fluence monitor (HAFM) technique was used with absolute amounts of helium determined by isotope-dilution mass spectrometry. Rates of /sup 235/U fission were measured in foils irradiated between B/sub 4/C pellets. Fission rate measurements used gamma ray counting techniques. Both helium production and fission rates were calculated using three-dimensional nodal transport methods. Measured helium production rates decreased about 18% within the first 63 mm of the pins, and decreased to 10 to 12% going from outer to inner pins in this small, 16 pin control assembly. The helium calculated and measured reaction rate profiles agreed within the 1 to 2% measurement uncertainties. Helium production rates were underestimated by calculations by about 8%.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 48302, 48434, 48525, 48615, 48615, 48617, 49221, 49608

48593 **(DOE/SSDP—0036) Licensing and regulatory process for the shipment of the Shippingport RPV [Reactor Pressure Vessel] package: Extended summary.** Van Sickle, G.E. (Westinghouse Hanford Co., Shippingport, PA (USA)). 1988. Contract AC06-76RL01857. 6p. (CONF-880903—11-Extd.-Summ.). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number TI88011145/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

At the Shippingport Station Decommissioning Project (SSDP) the irradiated hardware was essentially confined to those components that were a part of the reactor. The disposal of the irradiated reactor components was investigated by the Decommissioning Engineering Contractor. Due to the design of the reactor pressure vessel and its internals it was determined that the complete reactor vessel, its internal parts, and the neutron shield tank could be transported and disposed of as a single package. The technical feasibility of performing the one-piece shipment of the Reactor Pressure Vessel (RPV) package was reported in the Decommissioning Plan and the Environmental Impact Statement for the SSDP. 3 refs., 1 fig.

48594 (INIS-BR—1147-Vol.3, pp 447-455) **Field experiment - Phase 1: site representativeness.** Pendergrass, W.R.; McMillen, R.T.; Lima e Silva Filho, P.P. de. (National Oceanic and Atmospheric Administration, Oak Ridge, TN (USA); FURNAS, Rio de Janeiro (Brazil)). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The Atmospheric Turbulence and Diffusion Division (ATDD) of the National Oceanic and Atmospheric Administration (NOAA) and the Divisao de Seguranca Ambiental (DSEA.N) of Furnas Centrais Eletricas S.A. (FURNAS) have undertaken a joint field study to characterize atmospheric transport and diffusion at the complex site of the Angra Nuclear Power Plant (Angra 1) operated by FURNAS. Phase 1 experiments were designed to address questions of site representativeness with respect to the present meteorological monitoring system. Experiment teams undertook two week intensive measurement program consisting of tethersonde sounding coupled with neutral-lift balloon tracking. The data showed the site meteorology to be dominated by the local land/sea breeze effects. Daytime trajectories follow the local onshore flow until ridge top then indicate transport out to the ocean. Trajectories during the evening hours followed the drainage flow out to sea ending some distance from the shore or showing a tendency to follow the upper level onshore flow.

48595 **(NUREG/CR—5120) A model for the transport and chemical reaction of molten debris in direct containment heating experiments.** Marx, K.D. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Systems Safety; Sandia National Labs., Livermore, CA (USA)). May 1988. Contract AC04-76DR00789. 54p. (SAND—88-8213). NTIS, PC A04/MF A01 - GPO. Order Number TI88014939/JAW.

A computer model is described which simulates the effects of releasing molten debris into a gas-filled container. This work is motivated by studies of direct containment heating due to the dispersal of debris produced in certain nuclear reactor accident scenarios. The model consists of a finite-difference scheme for the gas flow coupled with a Lagrangian particle transport algorithm. It computes the transport of the debris through the gas and evaluates radiative and convective heat transfer effects. It also accounts for the chemical reaction of the debris with the oxygen in the atmosphere, including the concurrent heat release. The resulting computer code is used to simulate experiments in the Surtsey Direct Heating Test Facility. It is found that the computational results agree well with experiment for modest debris fluxes. It is further shown that the simulation of configurations with large fluxes can be improved with better submodels to describe the debris behavior. The description of the interaction of the debris with the container walls is of particular importance.

48596 **Numerical modeling of a nuclear production reactor cooling lake.** Hamm, L.L.; Pepper, D.W. (E.I. du Pont de Nemours and Co., Savannah River Lab., Aiken, SC (US)). pp 1-10 of International symposium on modeling environmental flows. Stock, D.E. New York, NY; American Society of Mechanical Engineers (1988). (CONF-871234—).

From ASME winter meeting; Boston, MA, USA (13 Dec 1987).

A finite element model has been developed which predicts flow and temperature distributions within a nuclear reactor cooling lake at the Savannah River Plant near Aiken, SC. Numerical results agree with values obtained from a 3-D EPA numerical lake model and actual measurements obtained from the lake. Because the effluent water from the reactor heat exchangers discharges directly into the lake, downstream temperatures at mid-lake could exceed the South Carolina DHEC guidelines for thermal discharges during the summer months. Therefore, reactor power was reduced to maintain tempertaure compliance at mid-lake. Thermal mitigation measures were studied that included placing a 6.1 m deep fabric curtain across mid-lake and moving the reactor outfall upstream. These measures were calculated to permit about an 8% improvement in reactor power during summer operation.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 48571, 48576, 48592, 48617, 48622, 49318, 49319, 49443

48597 **(CONF-880906—4) Three-dimensional calculations of neutron streaming in the beam tubes of the ORNL HFIR [High Flux Isotope Reactor] Reactor.** Childs, R.L.; Rhoades, W.A.; Williams, L.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012485/JAW.

From 7. international conference on radiation shielding; Bournemouth, UK (12 Sep 1988).

The streaming of neutrons through the beam tubes in High Flux Isotope Reactor at Oak Ridge National Laboratory has resulted in a reduction of the fracture toughness of the reactor vessel. As a result, an evaluation of vessel integrity was undertaken in order to determine if the reactor can be operated again. As a part of this evaluation, three-dimensional neutron transport calculations were performed to obtain fluxes at points of interest in the wall of the vessel. By comparing the calculated and measured activation of dosimetry specimens from the vessel surveillance program, it was determined that the calculated flux shape was satisfactory to transpose the surveillance data to the locations in the vessel. A bias factor was applied to correct for the average C/E ratio of 0.69. 8 refs., 7 figs., 3 tabs.

48598 **(GKSS—88/E/9) Research reactors for reactor materials development.** Ahlf, J. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1988. 6p. (In German). Special print from Atomwirtsch., Atomtech. (Jan 1988) v. 33(1) p. 36-39.

Also for the foreseeable future, research and test reactors are not going to lose their importance to research into reactor materials. Despite the technical maturity of today's fuel elements of pressurized and boiling water reactors, further studies are necessary in order to attain more economic fuel management strategies and future load following schemes of operation. Research programs are being conducted, for instance, to investigate the behavior of failed fuel rods with respect to fission product releases in continued operation, or to optimize fuel structures in order to achieve greater dimensional stability and lower fission product gas releases. Experiments performed to study fuel rods and rod bundles under loss-of-flow conditions make heavy demands on the measurement and control systems used and on the safety design of the whole test setups.

48599 **(GKSS—88/E/10) Cold neutron source with the FRG-1 research reactor.** Krull, W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Zentralabteilung Forschungsreaktoren). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Zentralabteilung Forschungsreaktoren). 1988. 6p. (In German). Special print from Atomwirtsch., Atomtech. (Jan 1988) v. 33(1) p. 43-47.

The approximately thirty-year-old FRG-1 research reactor of the GKSS Geesthacht Research Center will be equipped with a cold neutron source to increase the neutron flux for improved utilization of the beamhole experiments. The facility, which was installed by the Interatom/Riso Research Center consortium, is currently in the commissioning phase of its subsystems and started continuous operation with the FRG-1 at full power in early 1988. The experimental facilities of the cold neutron source are to be employed chiefly for materials research. Future areas of study will include the influence of impurities on the strength of steel, high-temperature materials, metallic glasses, hydrogen zones in materials welded under water, changes in materials properties under conditions of use. The cold neutron source has been designed so that no credible accident or combination of accidents and incidents or failure of the active safety measures can jeopardize the FRG-1 plant or third parties.

48600 (INIS-BR—1147-Vol.1, pp 97-108) **Safety analysis for the local faults of the PEC reactor fuel subassembly.** Dominici, G. (ENEA, Rome (Italy)). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

In the field of the safety analysis for the design accidents of the PEC fast reactor core, under construction in Italy, particular attention has been devoted to the "local faults" that can arise in a core fuel element. The safety analysis of these accidents, having the aim to guarantee the non-propagation to neighbouring subassemblies to avoid a whole core accident, has been recently completed. This paper describes: - the safety criteria that were imposed; - the categories of local faults that were considered; - the analyses that were carried out to verify the safety criteria, and their results; - the efficiency of the surveillance and control systems for the local fault situations.

48601 (INIS-BR—1147-Vol.1, pp 111-121) **Measurements and calculations of reactivity for the IEA-R1 reactor.** Ferreira, P.S.B.; Maiorino, J.R.; Yamaguchi, M. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

This work shows a measurement of reactivity parameters, such as integral and diferential control rod worth, local void coefficient, and moderator temperature coefficient for the research reactor IEA-R1. The measured values were compared with those calculated through HAMMER-CITATION codes, having shown good agreement.

48602 (INIS-BR—1147-Vol.1, pp 123-129) **Adjustement of Dancoff factor for calculating the cell of fluidized bed nuclear reactor.** Borges, V.; Sefidvash, F. (Rio Grande do Sul Univ., Porto Alegre (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A new nuclear reactor design based on the fluidized bed concept is under reserch and development. It utilized spherical fuel of slightly enriched zircaloy-clad uranium dioxide fluidized by light water under pressure since the Leopard code has been developed for light water reactor analysis, it was necessary to develop a method to determine the dimensions of the hypothetical fuel rod lattice, which are neutronically equivalent to the spherical fuel pellet lattice. This method is shown to calculate the Dancoff factor correctly.

48603 (INIS-BR—1147-Vol.1, pp 285-293) **Characteristics and operational parameters of IPR-R1.** Stasiulevicius, R. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The IPR-R1 nuclear research reactor, from Nuclear Technology Development Center of NUCLEBRAS, has been in operation since november 1960. The project features allow flexibility of handling, high security and realiable operation. This report describes briefly the reactor, the equipments for samples irradiations and presents the results of experiments, which were performed aiming to acquire better knowledge of the principal features and operationl parameters, which either are not still available, or have general interest for the efficient system use.

48604 (INIS-BR—1147-Vol.1, pp 395-403) **Superenergy-2: thermohydraulic validation and simulation of whole experimental fast reactor core.** Braz Filho, F.A.; Borges, E.M.; Hirdes, V.R. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

SUPERENERGY-2 is a code used to study the whole core thermalhydraulic behaviour in LMFBR type reactors. The purpose of this work is to verify the capabilities of the code in such analyses. The results obtained were satisfactory when comapred to theoretical and experimental data, and they confirm SUPERENERGY-2 to be an efficient code for the thermal design of these reactors.

48605 **(LA-UR—88-2008) Analysis of SP-100 critical experiments.** Sapir, J.L.; Brandon, D.I.; Collins, P.J.; Cowan, C.L.; Porter, C.A.; Andre, S.V. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 15p. (CONF-880911—14). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014429/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

In support of the SP-100 space nuclear power source program, preliminary critical benchmark experiments were performed at the ZPPR facility at ANL-W. These configurations are representative of small, fast-spectrum, BeO-reflected, liquid metal-cooled space reactor designs at a 300-kWe power level. Analyses were performed using MCNP (Monte Carlo) and TWODANT (discrete ordinates) transport codes to calculate system criticality, control worth, and power distribution. Both methods calculated eigenvalues within 0.5% of the experimental results. Internal-poison-rod worth was underpredicted and radial reflector worth was overpredicted by both codes by up to 20%. MCNP-calculated control drum worths were underestimated by approximately 8%. Good agreement with experimental values was observed for ^{235}U fission and for ^{238}U fission and capture rates with the best agreement occurring in the fuel region and slightly poorer predictions apparent near BeO moderator. 7 refs., 12 figs.

48606 **(LA-UR—88-2258) Postanalysis of the CNPS [Compact Nuclear Power Source] critical experiment.** Palmer, R.G. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-880911—11). NTIS, PC A03. Order Number DE88014322/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

The Compact Nuclear Power Source (CNPS) was designed to produce electric power for remote sites where fuel logistics and costs would justify a remotely sited nuclear power plant. Since the reactor was of novel design with no appropriate benchmarks, a series of critical experiments was carried out at LANL. This paper describes the methodology and reports the results of the postanalysis that was performed on the critical experiments, which included

several distinct critical configurations, the measurement of the isothermal temperature coefficient of reactivity and various material worths. Comparisons with measurements indicate that current methods and cross sections are adequate for calculating at least the beginning of life conditions in low enriched ^{235}U-graphite cores. 7 refs., 4 figs., 4 tabs.

48607 **(LA-UR—88-2272) Critical experiments in support of the CNPS [Compact Nuclear Power Source] program.** Hansen, G.E.; Audas, J.H.; Martin, E.R.; Pederson, R.A.; Spriggs, G.D.; White, R.H. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-880911—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014326/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

Zero-power static and kinetic measurements have been made on a mock-up of the Compact Nuclear Power Source (CNPS), a graphite moderated, graphite reflected, U(19.9% ^{235}U) fueled reactor design. Critical configurations were tracked from a first clean configuration (184 most central fuel channels filled and all control rod and heat pipe channels empty) to a fully loaded configuration (all 492 fuel channels filled, core-length stainless steel pipe in the twelve heat-pipe channels, and approximately half-core-length boron carbide in the outer 4 control rod channels. Reactor physics data such as material worths and neutron lifetime are presented only for the clean and fully loaded configurations.

48608 **(WHC-EP—0099) Fast Flux Test Facility performance monitoring management information.** Newland, D.J. (Westinghouse Hanford Co., Richland, WA (USA)). Nov 1987. Contract AC06-87RL10930. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014646/JAW.

The purpose of this report is to provide performance data on key performance indicators selected from the FFTF Early Warning System performance indicators. This report contains the results for key performance indicators divided into two categories of "overall" and "other". The "overall" performance indicators, when considered in the aggregate, provide one means of monitoring overall plant performance.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 48620, 48621, 48622, 48624, 48625, 48626, 48653, 49700

48609 **(CONF-880949—1) The irradiation dimensional changes of grade TSX graphite.** Kennedy, C.R.; Woodruff, E.M. (Oak Ridge National Lab., TN (USA); Westinghouse Hanford Co., Richland, WA (USA)). 1988. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88009698/JAW.

From CARBON '88; Newcastle upon Tyne, UK (18 Sep 1988).

Grade TSX graphite is used as a moderator in the N Reactor which has operated since 1963. This reactor, designed for a 25-year life, is under study to determine the possibility of significantly extending the operating life. One limiting factor is dimensional growth of the graphite lattice making up the core of the reactor. Since the original demands (25-year life) were modest, the dimensional change behavior was derived from a compendium of irradiation data from other grades and only confirmed by a few low-exposure irradiation experiments. Therefore, to generate actual dimensional change data for grade TSX to exposures relevant to the life extension plans, a series of irradiations of TSX graphite were run in the High Flux Isotope Reactor (HFIR) at Oak Ridge. This report contains experimental results of such testing. 5 refs., 3 figs.

48610 (INIS-BR—1147-Vol.1, pp 61-71) **Analysis of thermohydraulic limits in radioisotope producer reactor.** Botelho, D.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

For a 5 MW nuclear pool reactor it is required a thermohydraulic analysis in order to verify its safe operation within the required limits. The design must obey two main criteria: no onset of nucleate boiling on the surface of any fuel rod; the maximum lcoal heat flux must remain sufficiently below the critical heat flux. A verification of these limits for the conceptual design of the Radioisotopes Producer. Reactor (RPR) was completed, for the nominal conditions (5 MW; coolant at 2 m/s) as well as other conditions (Decay heat: 1 to 7% nominal power, coolant under natural convection). The analysis was based on heat transfer correlations appropriate to pool reactors. A bi-dimensional fluid flow and heat conduction and convection verification validates the mathematical correlations used.

48611 **(RTM—4676-Del.Ver.) Special hydraulic tests of emergency cooling system, L-Area.** Merz, G.F. (Savannah River Lab., Aiken, SC (USA)). 6 May 1985. Contract AC09-76SR00001. 22p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014510/JAW.

The delay in the L-Area startup provides an opportunity to obtain valuable data on the emergency cooling system (ECS). A series of special hydraulic tests of the ECS are proposed for L-Area. These tests are in addition to the test proposed by SRL. The tests will provide much needed empirical hydraulic data on the ECS piping for incorporation in computer models as well as improve the accuracy of manual calculations. The improved modeling and accuracy will permit reactor operation at the highest safe power level with respect to an ECS power limit. The magnetic flow meters in the ECS supply piping will allow rapid and accurate data collection. No special test equipment will be required. Only standard pressure and differential pressure instruments will be required in addition to the in-line flowmeters.

2208 Propulsion Reactors

48612 **(EGG-M—88279) Comparison of advanced nuclear and chemical propulsion.** Ramsthaler, J.H.; Sulmeisters, T. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 22p. (CONF-880764—3; AIAA—88-2927). American Institute of Aeronautics and Astronautics, 370 L' Enfant Promenade, S.W., Washington, DC 20024. Order Number TI88015225/JAW.

From 24. AIAA/ASME/SAE/ASEE joint propulsion conference; Boston, MA, USA (11 Jul 1988).

The country is developing a new heavy launch cargo vehicle. A complete low cost space transportation system will require new propulsion modules for moving payloads from low earth orbit to their final destination. Three propulsion concepts, a direct thrust nuclear stage, a nuclear electric stage, and a direct thrust chemical stage, have been compared for performing earth orbital transfer operations. The nuclear stages have the potential to be the most cost effective because of their lower propellant consumption. The direct thrust nuclear stage appears to be the most cost effective because of its high thrust compared to the nuclear-electric stage, its high specific impulse compared to the chemical stage, and its operational flexibility. Public acceptance of nuclear propulsion in space will require a more disciplined approach to design to ensure that reliability and safety are an integral part of the basic design. Operational concepts for nuclear systems are also important to safe operation and these should be studied early. A design process initiated in the design of the NERVA prototype flight engine is recommended as a starting point for implementing a rigorous design process. 7 refs., 3 figs., 5 tabs.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 48519, 48547, 48551, 48562, 48582, 48587, 48611, 48996, 49258, 49305

48613 (BMU—1987-172) Determination of elastic bearing capacity limits for additional seismic events. Main volume. Buchhardt, F.; Matthees, W.; Magiera, G.; Mathiak, F. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Bundesanstalt fuer Materialpruefung, Berlin (Germany, F.R.)). Dec 1986. 131p. (In German). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

In the Federal Republic of Germany KTA rule 2201 in the valid version 6/75 being the basis for the design of nuclear power plants against seismic events is now under discussion for revisions. One of the main demands to modify KTA rule 2201 consists in cancelling the existing design philosophy, i.e. design against an operating basis earthquake (AEB) as well as against a safe shutdown earthquake (SEB) in order to only design against the safe shutdown earthquake. It is the scope of this study to quantify by comprehensive, parametric analyses so-called 'elastic bearing capacity limit margins' for seismic events; hereby different seismic input criteria - conventional as well as recently proposed - are taken into account to investigate the influence of eventual modifications in seismic design philosophy. This way a relation between AEB and SEB has to be defined so that SEB is just still predominant for the design while AEB still will yield to elastic behaviour. The study covers all German site conditions.

48614 (BMU—1987-172/1) Determination of elastic bearing capacity limits for additional seismic events. Annex 1. Data on seismic input and dynamic load calculations. Buchhardt, F.; Matthees, W.; Magiera, G.; Mathiak, F. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Bundesanstalt fuer Materialpruefung, Berlin (Germany, F.R.)). Dec 1986. 181p. (In German). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

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48615 (CONF-880913—3) Applying radiological emergency planning experience to hazardous materials emergency planning within the nuclear industry. Foltman, A.; Newsom, D.; Lerner, K. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012057/JAW.

From ANS topical meeting on emergency response: planning, technologies and implementations; Charleston, SC, USA (26 Sep 1988).

The nuclear industry has extensive radiological emergency planning (REP) experience that is directly applicable to hazardous materials emergency planning. Recently, the Feed Materials Production Center near Cincinnati, Ohio, successfully demonstrated such application. The REP experience includes conceptual bases and standards for developing plans that have been tested in hundreds of full-scale exercises. The exercise program itself is also well developed. Systematic consideration of the differences between chemical and radiological hazards shows that relatively minor changes to the REP bases and standards are necessary. Conduct of full-scale, REP-type exercises serves to test the plans, provide training, and engender confidence and credibility.

48616 (CONF-880924—2) Lessons learned from the second Federal Radiology Emergency Response Plan Field Exercise (FFE-2). Adler, M.V.; Gant, K.S.; Weiss, B.H.; Wolff, W.F.; Adler, V. (Oak Ridge National Lab., TN (USA); Nuclear Regulatory Commission, Washington, DC (USA); USDOE, Washington, DC; Federal Emergency Management Agency, Washington, DC (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88008684/JAW.

From American Nuclear Society conference; Charleston, SC, USA (26 Sep 1988).

The FFE-2, held in 1987 at the Zion Nuclear Power Station, provided a large-scale, multiagency, field test of the Federal Radiological Emergency Response Plan (FRERP). The FRERP provided workable guidance for coordinating the federal response efforts and effectively supplementing the states' resources. Needs for more training for responders and clarification in portions of the response were identified.

48617 (DOE/EH—0067) Technical Safety Appraisal of the Advanced Test Reactor, EG and G Idaho, Inc. (USDOE Assistant Secretary for Environment, Safety and Health, Washington, DC. Office of Nuclear Safety). Apr 1988. 231p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88010964/JAW.

This report presents the results of one in a series of Technical Safety Appraisals being conducted of the Department of Energy's nuclear operations by the Assistant Secretary for Environment, Safety, and Health's Office of Nuclear Safety. This Technical Safety Appraisal of the Advanced Test Reactor at the Idaho National Engineering Laboratory site in southeastern Idaho was conducted during the time period of October 12 through November 6, 1987. This Technical Safety Appraisal addresses all operations associated with the Advanced Test Reactor (ATR) with the exception of the operation of the ATR Critical Facility. This low-power (5000 watts) facility is housed in an extension of the ATR spent-fuel storage pool and is operated as needed in support of the ATR Program. It was not in operation during the appraisal. Being an operational safety evaluation of an operating facility, this appraisal accepts as a given that the facility and its equipment have been appropriately designed, constructed, and tested. It also accepts as a given that the current safety analysis report adequately evaluates the risks presented by the operation. This appraisal does address, however, whether the facility and its current operations are consistent with those described in the safety analysis report and particularly whether the current operations are being conducted within the bounds of the operational safety requirements established for the operation.

48618 (DOE/SSDP—0033) Asbestos removal: Shippingport Station Decommissioning Project: Topical report. (Westinghouse Hanford Co., Shippingport, PA (USA)). 6 Jul 1988. Contract AC06-76RL01857. 47p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013365/JAW.

This topical report is a synopsis of the asbestos insulation removal performed at the Shippingport Station Decommissioning Project (SSDP). The information is provided, as a part of the Technology Transfer Program, to document the removal of asbestos insulation at a nuclear power station decommissioning project. The report covers the scope of work, regulations, engineering decisions, removal methods, lessons learned, and summaries from the detailed data base including manhours, asbestos removal volumes, radiation exposures, and asbestos airborne concentrations. 5 refs., 2 figs., 7 tabs.

48619 (DP-MS—88-31) Radioactive noble gas adsorption and irradiation studies. Monson, P.R. Jr. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 17p. (CONF-880815—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015395/JAW.

From 20. DOE/NRC nuclear air cleaning conference; Boston, MA, USA (22 Aug 1988).

In the event of a fuel melting accident at a nuclear reactor, a significant inventory of radioactive material could be released into the reactor room or containment vessel. This radioactive material would consist of particulate matter, iodine, tritium and the noble gases (krypton and xenon). In the case of reactors with containment domes, these gases would be contained for subsequent clean-up or treatment through a vented containment system. For reactors without containment domes the particulate matter and iodine can be effectively removed through conventional filtration; however, the noble gases would escape to the environment. In either case, it would be highly desirable to have a system that could be brought online to effectively remove the noble gases thereby minimizing the risk to offsite population. Savannah River Laboratory has been working on development of a Low Temperature Adsorption System (LAS) for treating radioactive noble gases released from a hypothetical reactor accident. This paper discusses recent results that indicate enhanced adsorption of radioactive xenon on silver mordenite and carbon versus non-radioactive xenon adsorption. Enhancement factors of up to 20 times were observed in tests carried out using the radioactive noble gases in the helium blanket gas of an operating reactor. Results of follow-up tests on the adsorption of non-radioactive noble gases under cobalt irradiation are also given. 5 refs., 16 figs., 6 tabs.

48620 **(DPST—84-912) Emergency Cooling System limits for the K-reactor heavy Mark 16B-31 charge.** Crowley, D.A. (Savannah River Lab., Aiken, SC (USA)). 15 Dec 1984. Contract AC09-76SR00001. 14p. NTIS, PC A03. Order Number DE88013943/JAW.

Power limits must be prescribed for each SRP reactor charge so that the Emergency Cooling System (ECS) will prevent core damage from exceeding 1% during a postulated loss-of-coolant accident or loss-of-pumping accident. For specified low probability circumstances the core damage must not exceed 5%. ECS limits have been specified for the Mark 15 charge and for the C-reactor 504 assembly Mark 22 charge. A Technical Standard presently defines minimum ECS flow requirements for the standard Mark 16B-31 charge. This document prescribes ECS limits for the Mark 16B and Mark 31A assemblies in the K-reactor heavy Mark, 16B-31. 18 refs., 6 figs.

48621 **(DPST—86-699) Revised Emergency Cooling System LOCA [loss-of-coolant accidents] limits for PKL-reactor Mark 16B-31 charges.** Church, J.P.; Steimke, J.L. (Savannah River Lab., Aiken, SC (USA)). 2 Oct 1986. Contract AC09-76SR00001. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013944/JAW.

Recent experiments have shown that the assembly damage models used to compute generic Emergency Cooling System (ECS) limits for loss-of-coolant accidents (LOCA) in Mark 16B-31 charges may be nonconservative. The bases of these damage models were experiments that underestimated the heat input into a heated flow channel. This document provides interim ECS limits for Mark 16, Mark 31A, and Mark 31B assemblies. 2 refs., 1 tab.

48622 **(DPST—86-839) Review of the causes of reactor incidents occurring during the period January to June 1986.** Busch, D.A.; Paradies, M.W. (Savannah River Lab., Aiken, SC (USA)). 15 Dec 1986. Contract AC09-76SR00001. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014508/JAW.

Reactor incident (RI) reports from January to June 1986 were reviewed to determine their root cause using a new cause coding system developed by the Reactor Safety Evaluation Division (RSED). The resulting root causes were then categorized and analyzed to identify those causes which led to the most incidents during the period and to develop corrective actions which, if implemented, could substantially reduce the number of incidents that occur. A second purpose was to develop a baseline distribution of root causes by category to provide a basis of comparison for the results of future analyses of this type. Trending of data of this type should further aid in the understanding of the root causes of RI's at Savannah River Plant (SRP) and serve as a measure of the effectiveness of corrective actions being taken to prevent recurrence. This report presents the distribution of root causes by major category, analyzes the collection of root causes in each of these categories for significance and meaning, and discusses possible corrective measures which could lead to significant reductions in the number of RI's that occur. 4 figs., 1 tab.

48623 **(EGG-M—40587) ATHENA [Advanced Thermal Hydraulic Energy Network Analyzer] simulation of a loss of coolant accident in a space reactor.** Roth, P.A.; Shumway, R.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 6p. (CONF-880702—18). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015122/JAW.

From 23. intersociety energy conversion engineering conference; Denver, CO, USA (31 Jul 1988).

The Advanced Thermal Hydraulic Energy Network Analyzer (ATHENA) code was used to simulate a loss-of-coolant accident (LOCA) in a conceptual space reactor design. ATHENA provides the capability of simulating the thermal-hydraulic behavior of the wide variety of systems which are being considered for use in space reactors. Flow loops containing any one of several available working fluids may interact through thermal connections with other loops containing the same or a different working fluid. The code can be used to model special systems such as: heat pipes, point reactor kinetics, plant control systems, turbines, valves, and pumps. This work demonstrates the application of the thermal radiation model which has been recently incorporated into ATHENA and verifies the need for supplemental reactor cooling to prevent reactor fuel damage in the event of a LOCA.

48624 **(EGG-TFM—7930) Simulation of inlet and outlet riser break sequences in the N Reactor.** Bolander, M.A.; Fletcher, C.D. (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1988. Contract AC07-76ID01570. 157p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88015090/JAW.

This report documents work performed at the Idaho National Engineering Laboratory (INEL) in support of the Westinghouse Hanford Company safety analyses of the N Reactor. The RELAP5/MOD2 computer code was used in analyzing two hypothetical transients. The computer code was modified specifically to simulate the refill behavior in the N Reactor process tubes. The transients analyzed were a double-ended rupture of an inlet riser column and a double-ended rupture of an outlet riser column.

48625 **(EGG-TFM—7962) Simulation of cold leg manifold break and station blackout revised sequences for reduced ECCS [emergency core cooling system] in the N Reactor.** Bolander, M.A.; Chapman, J.C.; Fletcher, C.D. (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1988. Contract AC07-76ID01570. 86p. NTIS, PC 05; 1; GPO Dep. Order Number DE88015092/JAW.

This report presents analyses of two loss-of-coolant-accident sequences of the N Reactor using the RELAPS/MOD2 computer code. RELAP5/MOD2 is a best estimate, two phase, nonhomogeneous, nonequilibrium, thermal-hydraulic, computer code designed for light water pressurized reactor transient. The N Reactor is a graphite- moderated, pressurized water reactor. The primary coolant is channeled through 1003 horizontal pressure tubes which contain two concentric tubular metallic fuel elements. The two accident sequences simulated were a double-ended guillotine break in the cold leg manifold and a station blackout. Both simulations cover the period beginning with the initiating event, either the break or the loss of ac power, to the stabilization of the core fuel element temperatures. (The station blackout calculation was carried out until the core was quenched.) The discussion presented in this report includes brief descriptions of the N Reactor, of the computer code and specific code modifications for horizontal reflood, and the computer code model used for the simulation. This discussion also presents the results and the analyses of the two calculations.

48626 (EGG-TFM—8026) Applicability of RELAP5/MOD2 to N Reactor safety analysis: Part 1, "Quick-look evaluation". Shumway, R.W.; Larson, J.R.; Jacobson, J.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1988. Contract AC07-76ID01570. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88015087/JAW.

This report is Part 1 of a two part evaluation of the ability of the RELAP5 computer code to calculate N Reactor transients. The RELAP5/MOD2 computer code, in modified form, has been used by EG and G Idaho and Westinghouse Hanford to model hypothetical N Reactor transients. Because RELAP5/MOD2 was developed primarily to model commercial pressurized water reactors (PWR), which have vertical fuel channels, its ability to accurately calculate the thermal-hydraulic phenomena in N Reactor type horizontal fuel channels has never been assessed. Part 1 of this study relies on readily available modeling information and Part 2 involves obtaining horizontal channel data and making new calculations and data comparisons.

48627 (FMPC—2151) Criticality safety studies for low enrichment uranium lattices in water. D'Aquila, D.M. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). 1988. Contract AC05-86OR21600. 12p. (CONF-8806175—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013763/JAW.

From People to people delegation to the Peoples Republic of China; Beijing, China (15 Jun 1988).

To calculate a nuclear criticality safety limit for a lattice of uranium pieces of uniform size and shape in water, an optimum lattice pitch search is typically performed to determine the pitch that will give the highest neutron multiplication factor and therefore ensure that a calculation of a nuclear criticality safety limit is conservative. When a safety limit for metal scarp of random size and shape is to be calculated, the size and shape of the metal that gives the highest neutron multiplication factor must also be determined. A criticality safety analysis for the shipment of low enriched uranium metal scrap is discussed in which an optimum triangular lattice pitch, metal size, and metal shape search were performed.

48628 (INIS-BR—1147-Vol.1, pp 253-263) **Emergency procedures of nuclear power plants-Evolution.** Atalla, D.L. (FURNAS, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

During the TMI event the operators had some difficulties to accurately diagnose the accident, causing delay to recover the plant, and allowing the conditions to deteriorate. Further analysis concluded that the plant emergency procedures were incomplete, and did not cover the possibility of multiple and simultaneous failures. This paper covers a new approach for developing emergency procedures to create a new general strategy by providing valid instructions for all kinds of possible incidents in a nuclear power plant.

48629 (INIS-BR—1147-Vol.1, pp 3-12) **Consequence of the operation of reactor cooling pumps during a loss of coolant accident by large break.** Santos, G.A. dos; Sabundjian, G. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The event of living on or turning off the operation of the Reactor Cooling Pumps-RCPs, in the case of a Loss of Coolant Accident - LOCA, has been a reason of a lot of studies after the Tree Mile Island 2 accident. Thus, it was investigated a large break LOCA in the cold leg of Angra 1, with the RELAP4/MOD5 Code during the blawdown. The attained results indicated that the best performance of the core was in the case where the RCPs had been turned off in the beginning of the transient, when compared with differents conditions of the RCPs.

48630 (INIS-BR—1147-Vol.1, pp 13-20) **Simplified methodology for analysis of Angra-1 containing.** Neves Conti, T. das; Souza, A.L. de; Sabundjian, G. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A simplified methodology of analysis was developed to simulate a Large Break Loss of Coolant Accident in the Angra 1 Nuclear Power Station. Using the RELAP5/MOD1, RELAP4/MOD5 and CONTEMPT-LT Codes, the time the variation of pressure and temperature in the containment was analysed. The obtained data was compared with the Angra 1 Final Safety Analysis Report, and too those calculated by a Detailed Model. The results obtained by this new methodology such as the small computational time of simulation, were satisfactory when getting the preliminar avaliation of the Angra 1 global parameters.

48631 (INIS-BR—1147-Vol.1, pp 73-80) **Loads of pressure wave in the emergency feedwater system of Angra-2 nuclear power plant.** Almeida Carvalho, E. de; El Chaer, C.R. (NUCLEN, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The Emergency Feedwater System of the Nuclear Power Plant Angra 2 has to be designed to resist, among others loads, to those produced by pressure waves caused by quick closing of the system check valves, as consequerce of the Emergency Feedwater Pump shut-down. The methodology for calculation of these loads, envolving the analytical simulation of the fluiddynamic system behavior, and the main results are presented in this paper.

48632 (INIS-BR—1147-Vol.2, pp 151-158) **Workers acting in the energy field - insalubrity and dangerous aspects.** Pereira, A.C.H.; Faria, N.M. de. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Workers acting in the energy field perform dangerous and insalubrious activities. In the Brazilian legislation in order to protect the workers most of these activities are classified. However the legislation doesn't include some activities that are performed by workers. This work intends to discuss this matter and to contribute to the evolution of the regulatory aspects of protection to workers in the energy field.

48633 (KFK—4274) Out-of-pile-experiments for the investigation of severe fuel damage. Description of the CORA facility. Hain, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projektgruppe LWR-Sicherheit). Jun 1987. 77p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754670/JAW.

As as consequence of the TMI-2 reactor incident an additional research program to investigate severe fuel damage (SFD) mechanisms was started in the Kernforschungszentrum Karlsruhe within the frame of the Nuclear Safety Project. An essential tool within this program is the CORA test facility. It is designed for the investigation of LWR fuel damage phenomena in the temperature range from 1200/sup 0/C through 2200/sup 0/C by out-of-pile single-rod and bundle experiments. In this report the conception and the actual design of the CORA facility are described.

48634 (KFK—4407) REBEKA bundle experiments. Study on interactions between ballooning Zircaloy cladding and emergency core cooling. Final report. Wiehr, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). May 1988. 138p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88754671/JAW.

This report is a summary of experimental investigations describing the fuel rod behavior in the refilling and reflooding phase of a loss-of-coolant accident of a PWR. The experiments were performed with 5x5 and 7x7 rod bundles, using indirectly electrically heated fuel rod simulators of full length with original PWR-KWU-geometry, original grid spacers and Zircaloy-4-claddings (Type Biblis B). The fuel rod simulators showed a cosine shaped axial power profile in 7 steps and continuous, respectively. The results describe the influence of the different parameters such as bundle size on the maximum coolant channel blockage, that of the cooling on the size of the circumferential strain of the cladding (azimuthal temperature distribution) a cold control rod guide thimble and the flow direction (axial temperature distribution) on the resulting coolant channel blockage. The rewetting behavior of different fuel rod simulators including ballooned and burst Zircaloy claddings is discussed as well as the influence of thermocouples on the cladding temperature history and the rewetting behavior. All results prove the coolability of a PWR in the case of a LOCA. Therefore, it can be concluded that the ECC-criteria established by licensing authorities can be fulfilled.

48635 (KWU-R—917/86/020) Benchmark exercise of the European Community on common cause failure. Final report. Doerre, P. (Kraftwerk Union A.G., Erlangen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1986. 36p. (In German). NTIS (US Sales Only), PC A03/MF A01; GPO Dep. Order Number DE88754607/JAW.

This report summarizes experiences and results of the contractor's contribution to the 'Second Reliability Benchmark Exercise of the European Community on Common Cause Failure' (CCF-RBE). The choice of a method for the treatment of dependent failures in a given reliability analysis depends on the purpose and aim of this analysis as well as on quality and extent of the available data, which may also influence the necessary degree of detail of the analysis. When data are applied to a system with different degree of redundancy, two types of errors have to be avoided which lead to extremely pessimistic assessments. (orig.) With 20 refs., 3 tabs., 1 fig.

48636 (LA—11274-PR) Space Nuclear Safety Program: Progress report, January-March 1987. Lewin, R. (ed.); George, T.G. (comp.). (Los Alamos National Lab., NM (USA)). Jul 1988. Contract W-7405-ENG-36. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015048/JAW.

This quarterly report describes studies related to the use of $^{238}PuO_2$ in radioisotope power systems, which were carried out for the Office of Special Nuclear Projects of the US Department of Energy by Los Alamos National Laboratory. Most of the studies discussed are ongoing; the results and conclusions described may change as the work progresses.

48637 (LA-UR—88-1919) The quench front revisited. Wendroff, B. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-8806194—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014448/JAW.

From 5. international conference on boundary and internal layers; Shanghai, China (20 Jun 1988).

The cooling of hot surfaces can be modeled in certain simples cases by a nonlinear eigenvalue problem describing the motion of a steady traveling cooling wave. Earlier work on the mathematical theory, the numerical analysis, and the asymptotics of this problem are reviewed.

48638 (NUREG—0090-Vol.11-No.1) Report to Congress on abnormal occurrences, January--March 1988. (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Jul 1988. 52p. NTIS, PC A04/MF A01 - GPO. Order Number TI88015974/JAW.

Section 208 of the Energy Reorganization Act of 1974 identifies an abnormal occurrence as an unscheduled incident or event which the Nuclear Regulatory Commission determines to be significant from the standpoint of public health or safety and requires a quarterly report of such events to be made to Congress. This report covers the period from January 1 to March 31, 1988. For this reporting period, there were three abnormal occurrences at nuclear power plants licensed to operate: a potential for common mode failure of safety-related components due to a degraded instrument air system at Fort Calhoun; common mode failures of main steam isolation valves at Perry Unit 1; and a cracked pipe weld in a safety injection system at Farley Unit 2. There were six abnormal occurrences at other NRC licensees: a diagnostic medical misadministration; a breakdown in management controls at the Georgia Institute of Technology reactor facility; release of polonium-210 from static elimination devices manufactured by the 3M Company; two therapeutic medical misadministrationS; and a significant widespread breakdown in the radiation safety program at Case Western Reserve University research laboratories. There was one abnormal occurrence reported by an Agreement State (Texas) involving radiation injury to two radiographers. The report also contains information updating some previously reported abnormal occurrences. 43 refs.

48639 (NUREG—0797-Suppl.16) Safety Evaluation Report related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2 (Docket Nos. 50-445 and 50-446). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Special Projects). Jul 1988. 162p. NTIS, PC A08/MF A01 - GPO. Order Number TI88015424/JAW.

Supplement 16 to the Safety Evaluation Report related to the operation of the Comanche Peak Steam Electric Station (CPSES), Units 1 and 2 (NUREG-0797), has been prepared by the Office of Special Projects of the US Nuclear Regulatory Commission (NRC). The facility is located in Somervell County, Texas, approximately 40 miles southwest of Fort Worth, Texas. This supplement presents the staff's evaluation of the applicant's Corrective Action Program (CAP) related to the design of conduit supports. The scope and methodologies for the CAP workscopes as summarized in Revision 0 to the conduit support project status reports and as detailed in related documents referenced in this evaluation were developed to resolve various design issues raised by the Comanche Peak Response Team (CPRT); CYGNA Energy Services (CYGNA); and the NRC staff. The NRC staff concludes that the CAP workscopes for conduit supports provide a comprehensive program for resolving the associated technical concerns identified by the CPRT, CYGNA, and the NRC staff. The NRC staff further concludes that implementation of the CAP workscope for conduit supports ensures that the design of conduit supports at CPSES satisfies the applicable requirements of 10 CFR Part 50.

48640 (NUREG—1252) Nuclear power plant thermal-hydraulic performance research program plan. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems). Jul 1988. 83p. NTIS, PC A05/MF A01 - GPO. Order Number TI88014921/JAW.

The purpose of this program plan is to present a more detailed description of the thermal-hydraulic research program than that provided in the NRC Five-Year Plan so that the research plan and objectives can be better understood and evaluated by the offices concerned. The plan is prepared by the Office of Nuclear Regulatory Research (RES) with input from the Office of Nuclear Reactor Regulation (NRR) and updated periodically. The plan covers the research sponsored by the Reactor and Plant Systems Branch and defines the major issues (related to thermal-hydraulic behavior in nuclear power plants) the NRC is seeking to resolve and provides plans for their resolution; relates the proposed research to these issues; defines the products needed to resolve these

issues; provides a context that shows both the historical perspective and the relationship of individual projects to the overall objectives; and defines major interfaces with other disciplines (e.g., structural, risk, human factors, accident management, severe accident) needed for total resolution of some issues. This plan addresses the types of thermal-hydraulic transients that are normally considered in the regulatory process of licensing the current generation of light water reactors. This process is influenced by the regulatory requirements imposed by NRC and the consequent need for technical information that is supplied by RES through its contractors. Thus, most contractor programmatic work is administered by RES. Regulatory requirements involve the normal review of industry analyses of design basis accidents, as well as the understanding of abnormal occurrences in operating reactors. Since such transients often involve complex thermal-hydraulic interactions, a well-planned thermal-hydraulic research plan is needed.

48641 **(NUREG/CR—0130-Add.4) Technology, safety and costs of decommissioning a reference pressurized water reactor power station: Technical support for decommissioning matters related to preparation of the final decommissioning rule.** Konzek, G.J.; Smith, R.I. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 98p. NTIS, PC A05. Order Number TI88014923/JAW.

Preparation of the final Decommissioning Rule by the Nuclear Regulatory Commission (NRC) staff has been assisted by Pacific Northwest Laboratory (PNL) staff familiar with decommissioning matters. These efforts have included updating previous cost estimates developed during the series of studies on conceptually decommissioning reference licensed nuclear facilities for inclusion in the Final Generic Environmental Impact Statement (FGEIS) on decommissioning; documenting the cost updates; evaluating the cost and dose impacts of post-TMI-2 backfits on decommissioning; developing a revised scaling formula for estimating decommissioning costs for reactor plants different in size from the reference pressurized water reactor (PWR) described in the earlier study; defining a formula for adjusting current cost estimates to reflect future escalation in labor, materials, and waste disposal costs; and completing a study of recent PWR steam generator replacements to determine realistic estimates for time, costs and doses associated with steam generator removal during decommissioning. This report presents the results of recent PNL studies to provide supporting information in four areas concerning decommissioning of the reference PWR: updating the previous cost estimates to January 1986 dollars; assessing the cost and dose impacts of post-TMI-2 backfits; assessing the cost and dose impacts of recent steam generator replacements; and developing a scaling formula for plants different in size than the reference plant and an escalation formula for adjusting current cost estimates for future escalation.

48642 **(NUREG/CR—4874) The sensitivity of evacuation time estimates to changes in input parameters for the I-DYNEV computer code.** Urbanik, T. II; Moeller, M.P.; Barnes, K. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Radiation Protection and Emergency Preparedness; Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 62p. (PNL—6172). NTIS, PC A04/MF A01 - GPO. Order Number TI88014608/JAW.

A study performed by the Pacific Northwest Laboratory (PNL) with the assistance of the Texas Transportation Institute for the US Nuclear Regulatory Commission (NRC) identifies the key input parameters to I-DYNEV affecting evacuation time estimates (ETEs). This study attempts to determine the sensitivity of ETEs to changes in input parameters when applied to two different evacuation networks. This information could then be used to determine parameters requiring additional research and to assist in the evaluation of ETEs submitted by licensees and applicants. The parameters analyzed for the study included vehicle population, network capacity, loading time, the capacity reduction factor, the time interval of processing, and free-flow velocity. These parameters were applied to two evacuation networks with different characteristics. Changes in each of the six input parameters evaluated for this study affected to some degree the estimates of evacuation times. In general, however, the results obtained revealed that the sensitivity of the evacuation time estimates to changes in the input parameters is consistent with traffic modeling theory and documented algorithms included in the model. 3 refs., 10 figs., 3 tabs.

48643 **(NUREG/CR—4920-Vol.1) Assessment of severe accident prevention and mitigation features: BWR [boiling water reactor], Mark I containment design.** Pratt, W.T.; Eltawila, F.; Perkins, K.R.; Fitzpatrick, R.G.; Luckas, W.J.; Lehner, J.R.; Davis, P. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems; Brookhaven National Lab., Upton, NY (USA)). Jul 1988. Contract AC02-76CH00016. 85p. (BNL-NUREG—52070-Vol.1). NTIS, PC A05/MF A01 - GPO. Order Number TI88014805/JAW.

Plant features and operator actions, which have been found to be important in either preventing or mitigating severe accidents in BWRs with Mark I containments (BWR Mark I's) have been identified. These features and actions were developed from insights derived from reviews of in-depth risk assessments performed specifically for the Peach Bottom plant and from assessment of other relevant studies. Accident sequences that dominate the core-damage frequency and those accident sequences that are of potentially high consequence were identified. Vulnerabilities of the BWR Mark I to severe accident containment loads were also identified. In addition, those features of a BWR Mark I, which are important for preventing core damage and are available for mitigating fission-product release to the environment were also identified. This report is issued to provide focus to an analyst examining an individual plant. This report calls attention to plant features and operator actions and provides a list of deterministic attributes for assessing those features and actions found to be helpful in reducing the overall risk for Peach Bottom and other Mark I plants. Thus, the guidance is offered as a resource in examining the subject plant to determine if the same, or similar, plant features and operator actions will be of value in reducing overall plant risk. This report is intended to serve solely as guidance.

48644 **(NUREG/CR—4920-Vol.2) Assessment of severe accident prevention and mitigation features: BWR, Mark II containment design.** Lehner, J.R.; Hsu, C.J.; Eltawila, F.; Perkins, K.R.; Luckas, W.J.; Fitzpatrick, R.G.; Pratt, W.T. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems; Brookhaven National Lab., Upton, NY (USA)). Jul 1988. Contract AC02-76CH00016. 107p. (BNL-NUREG—52070-Vol.2). NTIS, PC A06/MF A01 - GPO. Order Number TI88014806/JAW.

Plant features and operator actions, which have been found to be important in either preventing or mitigating severe accidents in BWRs with Mark II containments (BWR Mark II's) have been identified. These features and actions were developed from insights derived from reviews of in-depth risk assessments performed specifically for the Limerick and Shoreham plants and from other relevant studies. Accident sequences that dominate the core-damage frequency and those accident sequences that are of potentially high consequence were identified. Vulnerabilities of the BWR Mark II to severe-accident containment loads were also noted. In addition, those features of a BWR Mark II, which are important for preventing core damage and are available for mitigating fission-product release to the environment were also identified. This report is issued to provide focus to an analyst examining an individual plant. This report calls attention to plant features and operator actions and provides a list of deterministic attributes for assessing those features and actions found to be helpful in reducing the overall risk for Mark II plants. Thus, the guidance is offered as a resource in examining the subject plant to determine if the same, or similar, plant features and operator actions will be of value in reducing overall plant risk. This report is intended to serve solely as guidance.

48645 (NUREG/CR—4920-Vol.4) Assessment of severe accident prevention and mitigation features: PWR, large dry containment design. Perkins, K.R.; Hsu, C.J.; Lehner, J.R.; Luckas, W.J.; Cho, N.; Fitzpatrick, R.G.; Pratt, W.T.; Eltawila, F.; Maly, J.A. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems; Brookhaven National Lab., Upton, NY (USA)). Jul 1988. Contract AC02-76CH00016. 128p. (BNL-NUREG—52070-Vol.4). NTIS, PC A07/MF A01 - GPO. Order Number TI88014808/JAW.

Plant features and operator actions which have been found to be important in either preventing or mitigating severe accidents in PWRs with large dry containments have been identified. These features and actions were developed from insights derived from reviews of risk assessments performed specifically for the Zion plant and from assessments of other relevant studies. Accident sequences that dominate the core-damage frequency and those accident sequences that are of potentially high consequence were identified. Vulnerabilities of the large dry containment to severe accident containment loads were also identified. In addition, those features of a PWR with a large dry containment, which are important for preventing core damage and are available for mitigating fission-product release to the environment were identified. The report is issued to provide focus to the analyst examining an individual plant. The report calls attention to plant features and operator actions and provides a list of deterministic tributes for assessing those features and actions found to be helpful in reducing the overall risk for Zion and other PWRs with large dry containments. Thus, the guidance is offered as a resource in examining the subject plant to determine if the same, or similar, plant features and operator actions will be of value in reducing overall plant risk. This report is intended to serve solely as guidance.

48646 (NUREG/CR—4920-Vol.5) Assessment of severe accident prevention and mitigation features: PWR, ice-condenser containment design. Hsu, C.J.; Perkins, K.R.; Luckas, W.J.; Fitzpatrick, R.G.; Cho, N.; Lehner, J.R.; Pratt, W.T.; Eltawila, F.; Maly, J.A. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems; Brookhaven National Lab., Upton, NY (USA)). Jul 1988. Contract AC02-76CH00016. 136p. (BNL-NUREG—52070-Vol.5). NTIS, PC A07/MF A01 - GPO. Order Number TI88014809/JAW.

Plant features and operator actions which have been found to be important in either preventing and mitigating severe accidents in PWRs with ice-condenser containments have been identified. Thus features and actions were developed from insights derived from reviews of risk assessments performed specifically for the Sequoyah plant and from assessments of other relevant studies. Accident sequences that dominate the core-damage frequency and those accident sequences that are of potentially high consequence were identified. Vulnerabilities of the ice-condenser containment to sever accident containment loads were also identified. In addition, those features of a PWR with an ice-condenser containment, which are important for preventing core damage and are available for mitigating fission-product release to the environment were identified. This report is issued to provide focus to an analyst examining an individual plant. The report calls attention to plant features and operator actions and provides a list of deterministic attributes for assessing those features and actions found to be helpful in reducing the overall risk for Sequoyah and other PWRs with ice-condenser containments. Thus, the guidance is offered as a resource in examining the subject plant to determine if the same, or similar, plant features and operator actions will be of value in reducing overall plant risk. This report is intended to serve solely as guidance. 14 tabs.

48647 (NUREG/CR—4999) Estimation of risk reduction from improved PORV reliability in PWRs: Final report. Hsu, C.J.; Perkins, K.; Youngblood, R. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Accident Analysis; Brookhaven National Lab., Upton, NY (USA)). Mar 1988. Contract AC02-76CH00016. 64p. (BNL-NUREG—52101). NTIS, PC A05/MF A01 - GPO. Order Number TI88008327/JAW.

An analysis was performed to explore the risk reduction potential of improving the pressurizer PORV and block valve reliability for two representative PWR plants, Indian Point 3, and Oconee 3. Attention was focused upon particular transient scenarios including steam generator tube rupture (SGTR), a stuck-open PORV, cooldown to cold shutdown, and the use of PORV in low-temperature overpressurization (LTOP) protection. The feasibility of using the PORV as a high point vent to supplement the function of Reactor Vessel Head Vent System (RVHVS) was also studied.

48648 (NUREG/CR—5178) Evaluation of Generic Issue 125.II.7, reevaluate provision to automatically isolate feedwater from steam generator during a line break. Bruske, S.J.; Welland, H.J.; Cathey, N.G.; Valenti, L.N.; Bonney, R.F. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor and Plant Systems; EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1988. Contract AC07-76ID01570. 53p. (EGG—2544). NTIS, PC A04/MF A01 - GPO. Order Number TI88014920/JAW.

This report presents the evaluation of the potential safety concerns identified in Generic Issue 125.II.7, related to the automatic auxiliary feedwater (AFW) isolation from a steam generator during a main steam or feed line break. For this review, existing probabilistic risk assessments (PRAs) were evaluated to identify specific event tree sequences where the AFW system had failed. These sequences were used to calculate the contribution of AFW isolation system to the accident sequence frequency. By using this methodology, the change in risk (based on a change in core damage frequency) could be calculated for a plant with an automatic AFW isolation system compared with the same plant with the automatic AFW isolation system removed. The review evaluated one Westinghouse plant, one Combustion Engineering plant, and two Babcock and Wilcox design versions of a plant. Sections 3 and 4 of this report describe the methodology used to evaluate the various designs and provides the technical findings. Section 5 presents the cost benefit analysis performed to evaluate the various alternatives that were considered to resolve this issue. 19 refs., 4 figs., 8 tabs.

48649 (NUREG/CR—5203) Dynamic amplification of electrical cabinets. Bandyopadhyay, K.K.; Hofmayer, C.H.; Kassir, M.K.; Pepper, S.E. (Nuclear Regulatory Commission, Washington, DC (USA); Brookhaven National Lab., Upton, NY (USA)). Jun 1988. Contract AC02-76CH00016. 53p. (BNL-NUREG—52159). NTIS, PC A04/MF A01 - GPO. Order Number TI88015189/JAW.

BNL has studied the dynamic amplification of electrical equipment by use of existing test data. The study provides a relationship between the input motion at the base of an equipment and the output motion at a device location in the cabinet. The methodology used for analysis of the seismic test data, the results obtained from the analysis and the influence of various parameters in controlling the amplification factors are discussed in this report. The dynamic amplification factor at a location in the equipment is defined as the ratio of the spectral accelerations of the amplified motion at the particular location and the input motion at the base. The amplification factors are computed for various frequencies due to excitation in the front-to-back direction and the results are presented as amplification spectra in the frequency range 1--100Hz. The influence of various parameters in controlling the dynamic amplification factors has been studied. At low frequencies (e.g., < 16Hz), the amplification has a tendency to increase with the elevation in the cabinet and usually reaches a maximum value somewhere above the mid-height. At high frequencies (e.g., >16Hz), the amplification factors vary widely and may be maximum anywhere in the cabinet. Amplification is typically much higher (e.g., two to four times) at high frequencies than at low frequencies. The addition of a local stiffener significantly reduces the amplification value. Since the results of a low level resonance search test are used for qualification purposes (e.g. verifying mathematical model of an equipment), it is recommended that the limitations of the use of low level test results for predicting equipment performance at the qualification or fragility levels be better understood. 4 refs. 21 figs., 7 tabs.

40650 (PB—88-203385/XAB) Browns Ferry Nuclear Plant fire. Technical report. Pryor, A.J. (Energy Research and Development Administration, Albuquerque, NM (USA). Albuquerque Operations Office). Jun 1977. 51p. NTIS, PC A04.

A fire in the Browns Ferry Nuclear Plant involved polyurethane foams used to plug leaks at the point of cable penetration from the reactor building. The fire also involved the polyvinyl chloride cable insulation but no nuclear material. A candle used for leak detection ignited the polyurethane to start the fire which spread rapidly to the cables. Lack of qualified, experienced, fire-protection staffing contributed to the conditions that resulted in a direct loss of $10 million and an indirect loss of $30 million related to business interruption. Contributing to the rapid propagation and high loss were factors such as: poor design; fire-detection and fire-suppression systems were provided only on a partial or limited basis; polyurethane foam was used as a pressure differential seal/firestop; cable trays and seal/firestop installations did not meet design criteria. The most important element in improving the risk was determined to be the obtaining of management interest in fire safety.

40651 (PNL-SA—15881-2) A tool for site restoration planning following a nuclear weapons accident: Part 2, Developing a site restoration strategy. Tawil, J.J. (Pacific Northwest Lab., Richland, WA (USA)). May 1988. Contract AC06-76RL01830. 16p. (CONF-8806197—2-Pt.2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014764/JAW.

From US/Republic of France bilateral symposium on response to accidents involving trasuranium elements; Orleans, France (20 Jun 1988).

The objectives of this paper are to describe a process for developing site restoration strategies following a nuclear weapons accident, and demonstrate how to carry out this process using actual data from a military exercise. The exercise that I will be discussing is the Survey Response Force Exercise conducted in Savanna, Illinois in July 1986. It is called SRFX-86 for short. While a site restoration analysis using the SRP was conducted during the exercise, the present analysis is somewhat different in that it contains illustrations of some of the recent revisions and enhancements to the SRP. 5 figs., 3 tabs.

40652 (SAND—87-2812C) A survey of chemistry uncertainties in severe accident containment analysis. Bergeron, K.D. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 20p. (CONF-8806143—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014246/JAW.

From 2. nuclear reactor severe accident chemistry symposium; Toronto, Canada (5 Jun 1988).

In this paper a number of phenomenological issues are identified for which the uncertainties are judged to be particularly important for sever accident analysis. The criterion for selection is based on considerations of contribution to uncertainty in risk and likelihood that research can reduce the uncertainty. Two containment loading issues and four source term issues are considered. The topics discussed include gas combustion (e.g., detonation and/or deflagration of high temperature hydrogen-steam-air mixtures), radioisotope release (e.g., source term from molten debris/concrete interactions), radioisotope transport (e.g, influence of radiation on iodine/air/water chemistry), and interactions of molten debris with containment atmospheres (e.g., aerosol production from dispersed debris droplets). In each of the areas the impact of the uncertainties on accident analysis is addressed and current research efforts (if any) to reduce the uncertainties are identified. 33 refs., 1 fig.

40653 (UCRL—21069) Probabilistic flood hazard assessment for the N Reactor, Hanford, Washington. McCann, M.W. Jr.; Boissonnade, A.C. (Lawrence Livermore National Lab., CA (USA); Benjamin (J.R.) and Associates, Inc., Mountain View, CA (USA)). Jul 1988. Contract W-7405-ENG-48. 215p. NTIS, PC A10. Order Number DE88014938/JAW.

As part of a safety evaluation of the N Reactor on the Hanford Reservation, a probabilistic analysis was performed to assess the likelihood that flooding on the Columbia River could exceed elevations where safety-related structures and equipment are located. The study was performed by Jack R. Benjamin and Associates, Inc. (JBA) and managed by Lawrence Livermore Laboratory (LLNL). The results of this study suggest that extreme events must occur to generate floods that will exceed the elevations of structures and equipment at N Reactor. The most severe of these events are associated with a random or seismic failure of an upstream dam. The magnitude of these floods and their suddenness make them a considerably greater hazard than natural events. In comparison, hydrologic events contribute a relatively small amount to the frequency of extreme flows on the Columbia River.

40654 (WHC-EP—0094) A comparison of N Reactor and Chernobyl. McNeece, J.P.; Omberg, R.P.; Weber, E.T. (Westinghouse Hanford Co., Richland, WA (USA)). Mar 1988. Contract AC06-87RL10930. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014645/JAW.

The nuclear reactor accident at Chernobyl in the Soviet Union has resulted in a number of design reviews of the Hanford N Reactor because of some similarities between N Reactor and the Soviet RBMK reactor. While the two reactors have some common features, they also have many significant differences. In addition, the reactor characteristics associated with the common features are very different. This report compares key system design and operating features and points out the differences in N Reactor and the RBMK. A description of the Chernobyl accident provides a basis to show how the differences in the two reactors and the manner in which they are operated would preclude a similar accident in the N Reactor.

40655 (WHC-SA—0017) FFTF [Fast Flux Test Facility] Integrated Leak Rate Test Computer System. Hubbard, J.A. (Westinghouse Hanford Co., Richland, WA (USA)). Aug 1987. Contract AC06-87RL10930. 17p. (CONF-870837—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014616/JAW.

From 13. American Nuclear Society international meeting on nuclear power plant operation; Chicago, IL, USA (30 Aug 1987).

The Fast Flux Test Facility (FFTF) is a liquid-metal-cooled test reactor located on the Hanford Site. The FFTF is the only reactor of this type designed and operated with the intent of meeting the licensing requirements of the Nuclear Regulatory Commission (NRC). Unique characteristics of the FFTF that present special challenges related to leak rate testing include thin wall containment vessel construction, cover gas systems that penetrate containment, and a low-pressure design basis accident. The successful completion in 1986 of the third FFTF Integrated Leak Rate Test (ILRT) five days ahead of schedule and 10% under budget was a major achievement for the Westinghouse Hanford Company. The success of this operational safety test was due in large part to a special local area network (LAN) of three IBM PC/XT computers that monitored the sensor data, calculated the containment vessel leak rate, and displayed test results. The multiple computer configuration allowed continuous monitoring of the progress of the test independently of the data acquisition and analysis functions, and also provided improved overall system reliability by permitting immediate switching of computers if the equipment failed. 5 refs., 8 figs.

40656 Sensitivity studies of a seismically isolated system to low frequency amplification. Wu, T.; Seidensticker, R.W. (Argonne National Lab., Argonne, IL (US)). pp 461-468 of Seismic engineering: Recent advances in design, analysis, testing and qualification methods. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870636—).

From 5. national congress on pressure vessels and piping; San Diego, CA, USA (28 Jun 1987).

Responses of a seismically isolated structure to earthquake motions will depend primarily on the input ground motion and the isolation system frequency. The isolation frequency generally is relatively low when isolating against horizontal ground motions. After installation, the isolation frequency could deviate from its designed value due to aging, manufacturing tolerance etc. In addition, under certain soil conditions, the input motion could have high energy

content at relatively low frequencies. This report covers the first of these two concerns by performing a sensitivity study of the variations in isolation frequency on the responses of a nuclear reactor module incorporated with an isolation system. Results from a number of ground motions have shown that, for most earthquake motions, a high isolation frequency tends to yield higher maximum acceleration, higher transmitted shear force, and lower relative displacement between the isolated and unisolated parts of the structure. In one of the ground motions considered, a 7% increase in the isolation frequency from its original design value is observed to give over a 22% increase in the transmitted shear force.

48657 **Seismic fragility levels of nuclear power plant equipment.** Bandyopadhyay, K.K.; Hofmayer, C.H. (Structural Analysis Div., Dept. of Nuclear Energy, Bookhaven National Lab., Upton, NY (US)). pp 167-172 of Seismic engineering: Recent advances in design, analysis, testing and qualification methods. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870636—).

From 5. national congress on pressure vessels and piping; San Diego, CA, USA (28 Jun 1987).

Seismic fragility levels of safety-related electrical and mechanical equipment used in nuclear power plants are discussed. The fragility level is defined as the vibration level corresponding to initiation of equipment malfunctions. The test response spectrum is used as a measure of this vibration level. The fragility phenomenon of an equipment is represented by a number of response spectra corresponding to various failure modes. Analysis methods are described for determination of the fragility level by use of existing test data. Useful conversion factors are tabulated to transform test response spectra from one damping value to another. Results are presented for switch-gears and motor control centers. The capacity levels of these equipment assemblies are observed to be limited by malfunctioning of contactors, motor starters, relays and/or switches. The applicability of the fragility levels, determined in terms of test response spectra, to Seismic Margin Studies and Probabilistic Risk Assessments is discussed and specific recommendations are provided.

48658 **Piping system damping data at higher frequencies.** Ware, A.G. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID (US)). pp 261-270 of Seismic engineering: Recent advances in design, analysis, testing and qualification methods. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870636—).

From 5. national congress on pressure vessels and piping; San Diego, CA, USA (28 Jun 1987).

Research has been performed at the Idaho National Engineering Laboratory (INEL) for the United States Nuclear Regulatory Commission (USNRC) to determine best-estimate damping values for dynamic analyses of nuclear piping systems excited in the 20 to 100 Hz frequency range. Vibrations in this frequency range are typical of fluid-induced transients, for which no formal pipe damping guidelines exist. The available data found in the open literature and the USNRC/INEL nuclear piping damping data bank were reviewed, and a series of tests on a straight 3-in. (76-mm) piping system and a 5-in. (127-mm) system with several bends and elbows were conducted as part of this research program. These two systems were supported with typical nuclear piping supports that could be changed from test to test during the series. The resulting damping values were ≧ those of the Pressure Vessel Research Committee (PVRC) proposal for uninsulated piping. Extending the PVRC damping curve from 20 to 100 Hz at 3% of critical damping would give a satisfactory representation of the test data. This position has been endorsed by the PVRC Technical Committee on Piping Systems.

48659 **Laboratory piping system vibration tests to determine parametric effects on damping in the seismic frequency range.** Ware, A.G. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID (US)). pp 247-254 of Seismic engineering: Recent advances in design, analysis, testing and qualification methods. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870636—).

From 5. national congress on pressure vessels and piping; San Diego, CA, USA (28 Jun 1987).

A pipe damping research program is being conducted for the United States Nuclear Regulatory Commission at the Idaho National Engineering Laboratory to establish more realistic, best-estimate damping values for use in dynamic structural analyses of piping systems. As part of this program, tests were conducted on a 5-in. (128 mm ID) laboratory piping system to determine the effects of pressure, support configuration, insulation and response amplitude on damping. The tests were designed to produce a wide range of damping values, from very low damping in lightly excited uninsulated systems with few supports, to higher damping under conditions of either/or insulation, high level excitation, and various support arrangements. The effect of pressure at representative seismic levels was considered to be minimal. The supports influence damping at all excitation levels; damping was highest when a mechanical snubber was present in the system. The addition of insulation produced a large increase in damping for the hydraulic shaker excitation tests, but there was no comparable increase for the snapback excitation tests. Once a response amplitude of approximately one-half yield stress was reached, overall damping increased to relatively high levels (>10% of critical).

48660 **Theoretical and experimental dampling values of piping systems at high ductilities.** Ware, A.G. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID (US)). pp 237-246 of Seismic engineering: Recent advances in design, analysis, testing and qualification methods. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870636—).

From 5. national congress on pressure vessels and piping; San Diego, CA, USA (28 Jun 1987).

This paper presents a simplified theoretical explanation and test data for piping system damping during post-yield dynamic behavior. The theoretical frequency and damping variations with material ductility are discussed. The results of high excitation level tests from seven sources are described and correlated on common bases. Starting with 0% of critical damping at a local ductility of 1 (yield strain), damping values of from 30 to 50% of critical are estimated at the time of piping system failure. Since 50% of critical damping corresponds to no dynamic amplification at resonance, it is concluded that the input energy is being continually and completely dissipated by the forcing function changing the plastic dynamic deflection shape, with no dynamic amplification of displacements. An experimental method for consistent estimation of damping values at elastoplastic response levels is recommended.

48661 **Analysis of piping system response to seismic excitations.** Wang, C.Y. (Reactor Analysis and Safety Div., Argonne National Lab., Argonne, IL (US)). pp 141-148 of Seismic engineering: Recent advances in design, analysis, testing and qualification methods. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870636—).

From 5. national congress on pressure vessels and piping; San Diego, CA, USA (28 Jun 1987).

This paper describes a numerical algorithm for analyzing piping system response to seismic excitations. The numerical model of the piping considers hoop, flexural, axial, and torsional modes of deformation. Hoop modes generated from internal hydrodynamic loading are superimposed on the bending and twisting modes by two extra degrees of freedom. A time-history analysis technique using the implicit temporal integration scheme is addressed. The time integrator uses a predictor-corrector successive iterative scheme which satisfies the equation of motion. Both geometrical and material nonlinearities are considered. Multiple support excitations, fluid effect, piping insulation, and material dampings can be included in the analysis. Two problems are presented to illustrate the method. The results are discussed in detail.

48662 **Comparison of a quasistatic seismic strain range method with test and detailed transient analysis.** Weiner, E.O.; Peters, K.A.; Busch, K.A. (Westinghouse Hanford Co., Richland, WA (US)). pp 105-110 of Seismic engineering: Recent advances in design, analysis, testing and qualification methods. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870636—).

From 5. national congress on pressure vessels and piping; San Diego, CA, USA (28 Jun 1987).

A recently developed method for estimating the maximum strain range of a structure subject to seismic excitation has been applied to a one inch pipe test configuration. The method uses the concept of a simple substitute structure with physical constants developed from quasistatic plastic analysis of the full structure. Loads for the quasistatic analysis are modal loads gradually scaled to cover strain levels of interest. The substitute, subjected to the same excitation as the structure, represents the structure's important characteristics of strain concentration, structural system hardening and hysteretic damping. From test data, maximum strain ranges from 0.5% to 1.0% were obtained for four levels of strong sinusoidal shaking. The quasistatic method gave conservative predictions at all levels, on an average by about 30% of the test results. Reapplication of the method to detailed transient analyses of the same piping configuration also gave conservative results.

48663 **Seismic ratchet-fatigue failure of piping systems.** Severud, L.K.; Anderson, M.J.; Lindquist, M.R.; Weiner, E.O. (Westinghouse Hanford Co., Richland, WA (US)). pp 67-72 of Seismic engineering: Recent advances in design, analysis, testing and qualification methods. New York, NY; American Society of Mechanical Engineers (1987). (CONF-870636—).

From 5. national congress on pressure vessels and piping; San Diego, CA, USA (28 Jun 1987).

Failures of piping systems during earthquakes have been rare. Those that have failed were either made of brittle material such as cast iron, were rigid systems between major components where component relative seismic motions tore the pipe out of the component, or were high pressure systems where a ratchet-fatigue fracture followed a local bulging of the pipe diameter. Tests to failure of an unpressurized 3-inch and a pressurized 6-inch diameter carbon steel nuclear pipe systems subjected to high-level shaking have been accomplished. The high-level shaking loads needed to cause failure were much higher than ASME Code rules would permit with present design limits. Failure analyses of these tests are presented and correlated to the test results. It was found that failure of the unpressurized system could be correlated well with standard ASME type fatigue analysis predictions. Moreover, the pressurized system failure occured in significantly less load cycles than predicted by standard fatigue analysis. However, a ratchet-fatigue and ductility exhaustion analysis of the pressurized system did correlate reasonably well. These findings indicate modifications to design analysis methods and the present ASME Code piping design rules to reduce unneeded conservatisms and to cover the ratchet-fatigue failure mode may be appropriate.

48664 **(BMU—1987-172/2.1-2.2) Determination of elastic bearing capacity limits for additional seismic events. Annex 2. Pt. 1 and 2. Compilation of design reference data covering all German site conditions, including elastic bearing capacity limit margins.** Buchhardt, F.; Matthees, W.; Magiera, G.; Mathiak, F. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Bundesanstalt fuer Materialpruefung, Berlin (Germany, F.R.)). Dec 1986. 686p. (In German). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.; In 2 separate volumes.

In the Federal Republic of Germany KTA rule 2201 in the valid version 6/75 being the basis for the design of nuclear power plants against seismic events is now under discussion for revisions. One of the main demands to modify KTA rule 2201 consists in cancelling the existing design philosophy, i.e. design against an operating basis earthquake (AEB) as well as against a safe shutdown earthquake (SEB) in order to only design against the safe shutdown earthquake. It is the scope of this study to quantify by comprehensive, parametric analyses so-called 'elastic bearing capacity limit margins' for seismic events; hereby different seismic input criteria - conventional as well as recently proposed - are taken into account to investigate the influence of eventual modifications in seismic design philosophy. This way a relation between AEB and SEB has to be defined so that SEB is just still predominant for the design while AEB still will yield to elastic behaviour. The study covers all German site conditions.

25 ENERGY STORAGE

REFER ALSO TO CITATION(S) 48338

2502 Compressed Gas

REFER ALSO TO CITATION(S) 48494

2504 Capacitor Banks

48665 **(AD-A—193623/6/XAB) High power storage system based on thin-film solid ionics. Final report, July 1985-February 1988.** Balkanski, M.; Julien, C. (Paris-6 Univ., 75 (France). Lab. de Physique des Solides). Feb 1988. 19p. NTIS, PC A03/MF A01.

Thin-film insertion cathodes obtained in the In-Se system and Hall mobility up to 50 sq cm were measured on annealed films. Electrochemical lithium intercalation was performed and shows that a plateau appears at 1.8 V. The redox-stability range was determined by cyclic voltametry for different preparation conditions of the films. Lithium solid-state hybrid systems using borate glasses as electrolyte and lamellar compounds as intercalated electrode were tested from the point of view of storage applications. The secondary prototype built with a composite electrode including $NiPS_3$, carbon, and powdered electrolyte were set up and checked. Both thermodynamic and kinetic parameters are given under high-power storage conditions.

2506 Thermal

REFER ALSO TO CITATION(S) 48430

48666 **(HAA—051981) A proposal prepared for Public Works Canada on the demonstration of aquifer thermal energy storage. Phase 2.** (Hooper and Angus Associates Ltd., Toronto, Ontario (Canada)). May 1981. 35p. (CE—01685). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This proposal stems from work whose principal objective was to assess the feasibility of aquifer thermal energy storage technology at the Atmospheric Environment Service building in North York, Ontario. It was shown, upon reviewing the building physical plant and loads, as well as testing and sampling the aquifer formation, that an aquifer based cooling system demonstration would be feasible and effective at this location. It is the purpose of further phases of work to develop the ATES concept beyond the feasibility stage with the aim being to clearly demonstrate system performance and operational characteristics. The objective of this proposal is the development of detailed design specifications. This proposal stresses the need for both engineering analysis and design. A necessary precursor to the preparation of design specifications is the analysis phase of work needed to more completely understand the interaction of the fundamental processes. Every indication during the feasibility study pointed to the fact that this aquifer formation has favourable storage characteristics. This should be confirmed through the detailed analytical work proposed which includes aquifer sampling, testing and modelling. Further study of the building mechanical plant and cooling load is necessary. The interface between the aquifer and building needs to be considered in detail. The systems approach to the design of this complex system is proposed. This method has significant advantages when systems of a prototype nature are being developed. Project costing and scheduling are included. 6 figs., 2 tabs.

48667 **(PW—101981) Project Snowbowl.** (Public Works Canada, Ottawa, Ontario). Oct 1981. 46p. (CE—01687). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Every year large quantities of snow are trucked to disposal sites in Canada at a high fuel cost. Two and a half cubic feet of

snow have the capacity to satisfy the cooling needs of 600 square feet of office space for one hour, normally produced by refrigeration systems at a cost of $0.06 per ton hour, at least $0.05 of which is spent on energy. These facts prompted a study of the feasibility of seasonal energy exchange through the cooling of buildings with stored winter snow. An office building in Ottawa and an adjacent quarry appeared to offer many advantages to be considered in such a study, which considered development of the quarry for snow storage, a system for energy transfer and a weather cover for the exposed snow. Two energy transfer systems were studied: a grid system of pipes on the quarry floor under the snowpile to circulate cooled water to the building, and a heat exchanger system which would circulate meltwater through a heat exchanger in the building. A search for a sufficiently durable cover which would provide, at reasonable cost, a reflective surface and a degree of thermal insulation was not entirely successful. Two options for quarry development were considered, the first to provide for maximum snow storage capacity and the second to incur the least development costs. It was recommended that the quarry be developed according to the least cost option and to utilize the heat exchanger energy transfer system. Capital cost was estimated at about $240,000 with a 9.5 year payback period. 1 ref., 7 figs., 1 tab.

48668 (SAND—87-3149) Hydrogen sorption studies of materials used in Li(Si)/FeS_2 thermal batteries. Assink, R.A.; Schneider, D.A.; Guidotti, R.A. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1988. Contract AC04-76DP00789. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013154/JAW.

Hydrogen formation occurs during long-term storage of Li(Si)/FeS_2 thermal batteries as a result of residual moisture reacting with the Li(Si) anode. A study of the rates of hydrogen sorption by materials used in Li(Si)/FeS_2 thermal batteries was undertaken in order to obtain a measure of their reactivity to hydrogen in the thermal battery environment. The sorption of hydrogen by pellets of the anode material, separator mix, catholyte mix, and heat powder was monitored for periods of up to a month at a temperature of 60{degree}C. The anode material was 44% Li/56% Si alloy; the separator was 65% LiCl-KCl eutectic/35% MgO; the catholyte was 75% FeS_2/25% electrolyte binder mix (with the composition 88% LiCl-KCl eutectic/12% SiO_2; and the heat powder was 88% Fe/12% $KClO_4$. Individual components of the mixes exhibiting significant sorption of hydrogen were examined, and the FeS_2 was the only material found to be actively sorbing hydrogen. The kinetics of the sorption process were enhanced by a smaller particle size of FeS_2, a higher hydrogen pressure, and a higher level of oxidized iron impurities. The hydrogen was not removed by vacuum heating at 200{degree}C. A hydrogen sorption study of the insulation materials used in the battery showed the ceramic-fiber blanket to be a significant sorbent for hydrogen. 7 refs., 10 figs., 5 tabs.

48669 A numerical and experimental study of stratified thermal storage. Oppel, F.J.; Ghajar, A.J.; Moretti, P.M. (Sandia National Labs., Albuquerque, NM (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **92**: No. 2A, 293-309(1986). (CONF-8606125—).

From ASHRAE annual meeting; Portland, OR, USA (22 Jun 1986).

Technical Paper 2995.

A one-dimensional, implicit, finite-difference model of a single stratified thermal storage tank has been developed. The model covers variable flow rates for charging or discharging the thermal storage tank and conduction and turbulent mixing within the water for two different inlet configurations. In order to handle variable flow rates, a "conceptual buffer tank" algorithm was developed. Turbulent mixing occurring in the tank was simulated through thermal eddy conductivity factors, which were determined from experimental data. A decreasing hyperbolic function predicted the best variation of the eddy conductivity factor inside the tank. A general relationship between the inlet eddy conductivity factor and the ratio of Reynolds number over Richardson number was established for the inlets investigated. The simulation model adequately predicted the experimental data. In addition, the model reproduced hydraulic test data better than a recent one-dimensional model found in the literature.

2508 Chemical

48670 (AD-A—193778/8/XAB) Charge storage and switching phenomena in metal complexes. Final report, 14 February 1986-31 December 1987. De Armond, M.K.; Hanck, K.W.; Wertz, D.W. (North Carolina State Univ., Raleigh (USA). Dept. of Chemistry). 14 Mar 1988. 3p. NTIS, PC A02/MF A01.

The purpose of the research is to identify intramolecular charge separation and charge-localization phenomena that can when incorporated into polymer materials provide the basis for molecular switching phenomena. The first year and a half of the work was spent designing monomer molecules possessing unusual photophysical properties and determining the physical measurement technique to be exploited with the polymers. A unique multiple emitting Ru(II) compound containing the 2,2-dipyridylamine ligand has been identified and the photophysical properties measured.

2509 Batteries

REFER ALSO TO CITATION(S) 49615

48671 (AD-A—193025/4/XAB) Nickel-hydrogen cell positive-electrode studies: cobalt segregation in reducing environments. Zimmerman, A.H. (Aerospace Corp., El Segundo, CA (USA). Laboratory Operations). 22 May 1987. 44p. (TR—0086A(2945-01)-4). NTIS, PC A03/MF A01.

Nickel electrodes from nickel-hydrogen battery cells that had exhibited anomalously low capacities were tested. Electrode-characterization tests showed that changes had occurred in the electrode-active material to increase the charge and discharge voltages. The increased charge voltages resulted in a decrease in charge efficiency. These changes apparently resulted from storage of the cell at low voltage with excess hydrogen present in the cell. Chemical and physical analyses indicated that cobalt, a 10% additive in the nickel electrode-active material, had undergone segregation from the active material to form a cobalt-rich compound that is not normally present in the electrodes. This chemical change is felt to be largely responsible for the changes in electrode performance. A model for the processes causing cobalt segregation is described, and test results are presented to support the model.

48672 (AD-A—193208/6/XAB) Preparation and development of advanced battery catalysts. Interim report, August 1986-February 1987. Kilroy, W.P.; Abraham, K.M.; Alamgir, M. (EIC Labs., Inc., Norwood, MA (USA)). 1 Oct 1987. 61p. (C—868). NTIS, PC A04/MF A01.

New catalysts that improve the discharge performance of Li/$SOCl_2$ cells were identified. These catalysts were obtained by thermal treatment of acetylene black carbon doped with the precursors, $Co(NO_3)_2$, manganese phthalocyanine (MnPc) or vanadium phthalocyanine oxide (VOPc). The latter two materials appear to be superior to many catalysts presently available for use in Li/$SOCl_2$ cells. Compared with uncatalyzed cells, MnPc-containing cells showed a 60% increase in cell capacity and a 10% increase in cell voltage at room temperature. VOPc-containing cathodes increased the cell capacity by 50% and cell voltage by 10% under the same conditions. The use of VOPc also resulted in significant improvements in cell performance at low temperature, e.g., at -30 C.

48673 (AD-A—193243/3/XAB) Role of lithium passivation in $LiSO_2$. Technical report. Bittner, H.F. (Aerospace Corp., El Segundo, CA (USA). Chemistry and Physics Lab.). 29 Dec 1986. 27p. (TR—0086(6945-01)-1). NTIS, PC A03/MF A01.

The role of the lithium passivation layer on lithium sulfur dioxide (Li/SO_2) cell performance was studied. Polarization attributed to the Li layer was characterized; an initial polarization (voltage delay) was in some cases followed by a secondary polarization. It was found that long-term, low-rate discharge modified the Li passivation layer, which resulted in increased Li corrosion and decreased cell capacity. The degradation was greater at high temperature. Short-term partial discharge was also found to result in in-

creased Li corrosion. Analysis of formation of the Li layer was studied by surface analytical techniques. Results were interpreted in terms of a primary layer, which was responsible for the passivation, and a thicker, porous secondary layer. Formation of the secondary layer is exacerbated by partial discharge.

48674 **(AD-A—193766/3/XAB) Polymeric electrolytes. Technical report.** Blonsky, P.M.; Clancy, S.; Hardy, L.C.; Harris, C.S.; Spindler, R. (Northwestern Univ., Evanston, IL (USA). Materials Research Center). 1987. 23p. (TR—019). NTIS, PC A03/MF A01.

Research on solvent-free polymer electrolytes is currently very active, because of their potential applications in high energy density batteries, specific ion sensors, electrochromic displays, and other electrochemical devices. Pure ionic and mixed ionic-electronic conducting polymer-salt complexes will be discussed in the report. Vibrational spectroscopy, x-ray diffraction, and EXAFS spectroscopy studies have provided structural information on PEO-salt complexes. For the sodium and lithium complexes, the cations are coordinated to the polyether oxygen atoms, and these cations reside within the helical tunnel of the PEO which is in a (T2GT2G) conformation. This proposed structure is comparable to the complexes formed between alkali metal salts and crown ethers. The formation of PEO-salt complexes, can be understood in terms of a balance between the lattice energy of the salt and the coordination energy of the cation by the polymer. In general, salts with large mononegative anions favor complex formation because of their low lattice energies.

48675 **(AD-A—193984/2/XAB) Overcharge behavior of polymer-electrolyte cells. Technical report No. 14, 15 July 1985-October 1987.** Gopaliengar, R.; Munshi, M.Z.; Owens, B.B. (Minnesota Univ., Minneapolis (USA). Corrosion Research Center). 23 Oct 1987. 14p. NTIS, PC A03/MF A01.

Polymer complexes formed by the reaction of an alkali-metal salt and polyethylene oxide (PEO) were first shown to be fast-ion conductors at 100 C by Fenton and co-workers. Subsequently, a large number of groups have shown an interest in the application of these polymeric solid materials. The encouraging results led to the use of these materials in solid state batteries as solid electrolytes. One such material (PEO)8.$LiCF_3SO_3$ exhibited sufficient conductivity and electrochemical stability. A major goal in battery research is to develop an all-solid-state rechargeable battery with the ability to store and to deliver energy efficiently and economically. Batteries based on alkali-metal anodes such as lithium and insertion cathodes such as V_6O_{13} or TiS_2 have been the common systems under current study. The low equivalent weight and high negative electrode potential of lithium allow the fabrication of cells with high open-circuit voltages and high energy densities.

48676 **(AD-A—193985/9/XAB) Measurement of Li^+ ion transport numbers in PEO-LiX complexes. Technical report No. 16, 15 July 1985-January 1988.** Munshi, M.Z.; Owens, B.B.; Nguyen, S. (Minnesota Univ., Minneapolis (USA). Corrosion Research Center). Mar 1988. 17p. NTIS, PC A03/MF A01.

Lithium-ion conducting-polymer materials are being intensively investigated in a number of research laboratories because of their potential use as solid electrolytes in high-energy-density solid-state lithium batteries. The most-widely used polymer were based on polyethylene oxide (PEO). The conduction mechanism in these polymer electrolytes has generally been assumed to be due to Li(+)ion transport from one lone pair site to another along the helical PEO strands. However, recent studies have shown that the Li(+) transport number is less than unity. The transport number for Li(+) ions in PEO-LiX complexes was measured using a potentiostatic polarization technique. The results indicate that the Li(+) ion transport is strongly influenced by the salt concentration and the type of counter ions.

48677 **(AD-A—193986/7/XAB) Ionic transport in polyethylene oxide PEO-LiX polymeric solid electrolyte. Technical report No. 17, 15 July 1985-January 1988.** Munshi, M.A.; Owens, B.B. (Minnesota Univ., Minneapolis (USA). Corrosion Research Center). Mar 1988. 18p. NTIS, PC A03/MF A01.

The ionic-conductivity behavior of polyethylene oxide complexed with lithium salts was investigated using an a.c. impedance technique. The composition range of the salt was from 0.01 to 0.5 mole fraction. The result showed that anions strongly influence the conductivity behavior of the polymer electrolyte. A simple model is proposed whereby the conductivity decrease at higher salt concentration is due to ion-pair formation. This results in an increase in the activation energy with increasing salt concentration and a reduction in the ionic mobility of Li ions.

48678 **(AD-A—193987/5/XAB) Optimization and scale-up performance of polymer-electrolyte batteries. Technical report No. 13, 15 July 1985-October 1987.** Munshi, M.A.; Owens, B.B. (Minnesota Univ., Minneapolis (USA). Corrosion Research Center). 23 Oct 1987. 12p. NTIS, PC A03/MF A01.

The rechargeable high-energy-density polymer electrolyte battery utilizing a lithium anode, polyethylene oxide-salt complex electrolyte and a V_6O_{13} composite cathode was investigated in this laboratory. Cycled tests indicate good adhesion at the anode/electrolyte and electrolyte/cathode interfaces, even after one-hundred deep cycles. A modified polymer electrolyte with relatively higher room-temperature ionic conductivity was also employed in cells at ambient temperature. Scaled-up designs are under evaluation.

48679 **(AD-A—193988/3/XAB) Performance of polymer-electrolyte cells at +25 to +100 C. Technical report.** Munshi, M.A.; Owens, B.B. (Minnesota Univ., Minneapolis (USA). Corrosion Research Center). 1987. 19p. NTIS, PC A03/MF A01.

Solid-state rechargeable polymer-electrolyte batteries utilizing lithium anodes and V_6O_{13} composite cathodes were investigated at 100 C. The polymer electrolyte was a complex formed between polyethylene oxide (PEO) and $LiCF_3SO_3$. Over a hundred cycles were obtained at the C/5 rate (45% depth of discharge) with greater than 75% of the initial capacity of V_6O_{13} being maintained at cycle number one-hundred. Cells made with propylene carbonate (PC)-doped polymer electrolyte also showed good performance at room temperature.

48680 **(CRIE-T—86088) Evaluation of Li/MoS_2 secondary battery for load-conditioner. Deep-cycle performance of AA-size cells.** Terada, Nobuyuki; Kumai, Kazuma; Ishihara, Kaoru. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Sep 1987. 26p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753437/JAW.

The load-conditioner (LC) requires the battery which could deliver reliably high energy for a long period. For this, the lithium/molybdenum disulfide cell, technological development of which is most advanced among new type batteries, is a strong candidate even from the viewpoint of cost. In this report, the basic performance of AA-size Li/MoS_2 cells which are now test-manufactured and available in the market, was investigated and the following items were examined: 1) Does it have performance superior to a Ni/Cd cell as a substitute for lead battery. --Its initial performance, which shows light discharge efficiency of 90% or more and energy density of 40-55Wh/kg, demonstrates the prospect of the battery as a new battery of light-weight and high power output. However, it requires a constant voltage circuit for the use as LC and its duration is shorter than that of Ni/Cd cell. 2) Is it made in a large scale which is necessary for LC. --Making it in a large scale is possible by inter alia making electrode material, etc. into thin film, making the electrode area large and making current density small. 3) What kind of technological development is necessary for the use as LC. -- For achieving its long durable life, such technological developments as improvement of electrolyte, etc. are needed. (10 figs, 7 tabs, 9 refs)

48681 **Analysis and interpretation of ac impedance data for porous electrodes.** Springer, T.E.; Raistrick, I.D. (Los Alamos National Lab., Los Alamos, NM (US)). pp 152-165 of Electrode materials and processes for energy conversion and storage. Srinivasan, S.; Wagner, S.; Wroblowa, H. Pennington, NJ; The Electrochemical Society (1987). (CONF-8705216—).

From 2. symposium on electrode materials and processes for energy conversion and storage; Philadelphia, PA, USA (11 May 1987).

Ac impedance spectroscopy has been used to measure the dynamic response of two types of porous gas-diffusion oxygen electrodes in a sulphuric acid electrolyte. Models were developed based on flooded and on thin-film pore structure. The transfer functions of these structures were calculated and the impedance result fitted to the models using a nonlinear least squares program. The results were used to assess the adequacies of the models.

29 ENERGY PLANNING AND POLICY

48682 **(AFME—82-ET-173) Energy conservation in developing countries.** (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1983. 465p. (In French). NTIS (US Sales Only), PC A20/MF A01; GPO Dep. Order Number DE88754621/JAW.

The aim of this study was the analysis of the energy demand and its trend in the developing countries and of the middle and long term energy conservation politics of these countries. A comprehensive survey of energy consumption in developing countries (divided in five zones: Africa, Latin America, India, South East Asia and advanced developing countries) is conducted in various energy consumption domains: agriculture, industry, transportation and domestic consumption. The possible energy savings are evaluated for the five to twenty coming years.

48683 **(AFME—83-0976) Analysis of the energy cooperation politics with developing countries.** (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). Mar 1984. 163p. (In French). NTIS (US Sales Only), PC A08/MF A01; GPO Dep. Order Number DE88754627/JAW.

The aim of this study was to investigate the effects of international energy cooperation on the development of developing countries and to establish the characteristics and orientations of french cooperation politics concerning energy. The various energy demand and supplies in those countries are evaluated and the different forms of technology transfer or technical help are compared in order to select the most appropriate ones for the developing country economy. Cultural and sociological aspects are considered.

48684 **(GB—149) Competition in electricity? The government's proposals for privatising electricity supply.** Robinson, C. (Surrey Univ., Guildford (UK)). (Institute of Economic Affairs, London (UK)). 1988. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754295/JAW.

In the Government proposals for privatising the electricity supply industry the CEGB is to be split, transmission is to be separated from generation, the obligation to supply is to be transferred solely to distributors and there are to be penalties for poor service. These good points are overshadowed by the failure to establish the conditions for effective competition in generation. The duopoly which is to replace the CEGB and the obligation on the major generator to promote nuclear power will almost certainly restrict competition so that an impossible burden will be placed on a regulatory body attempting to protect consumers. Distributor control of both the electricity transmission and the distribution networks may also constrain competition, as may the ability of distributors to generate. The only form of coal privatisation which seems possible will be as a monopoly. The White Paper is, however, only an outline; the Government's views may evolve towards the injection of more competition. The principal needs are to establish more generators from the outset to form a separate nuclear company and to introduce new management into the industry. A liberal form of coal privatisation would then be possible.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 48846, 48887, 48915

48685 **(CONF-8403264—Exc.) Energy supply and regional structure.** (Deutsche Akademie fuer Staedtebau und Landesplanung, Muenchen (Germany, F.R.). Inst. fuer Staedtebau und Wohnungswesen (ISW)). 1985. 261p. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

The book contains the scenarios of 14 papers from 3 conferences about problems of energy supply in connection with objectives related to urban and regional planning. Specific investigations and energy supply concepts are illustrated by examples from several cities and districts in the Federal Republic of Germany. Cogeneration, waste heat utilization, energy conservation measures, the planning of buildings and housing estates in accordance with the climatic conditions, and helps in planning site engineering for communities are the main topics showing the importance of energy-political concepts to regional planning and restructuring of cities. (PJH).

48686 (CONF-8403264—Exc., pp 1.1.1-1.1.16) **Problems of regional development; objectives relating to regional arrangement and problems of energy supply.** Brake, K. 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

The report deals with the question of what regional planners should orientate themselves at when they are to pay attention to the principle of saving energy. The main problems to be dealt with on the conference are shown at the recommendations of the Advisory Board on Regional Arrangement relating to regional aspects of energy supply and energy saving of March 11, 1982. In these recommendations, regional planning policy and energy policy are said to be closely coherent regarding the realization of their objectives; the drafting of regional supply concepts is recommended. These concepts should mainly include pre-estimations of the energy demand, data on the structures of energy sources, the reduction of the environmental pollution which is aimed at and guidelines for the expansion and structuring of transmission-bound energy supply. (PJH).

48687 **(FRNC-TH—3284) Calculation methods for optimal control in a heating/air conditioning system including a heat pump and a double thermal storage.** Vasselin, P.H. (Ecole Nationale des Ponts et Chaussees (ENPC), 75 - Paris (France)). Dec 1986. 188p. (In French). NTIS (US Sales Only), PC A09/MF A01; GPO Dep. Order Number DE88754629/JAW.

Two computer programmes are presented for the operation optimization of a building space heating and air conditioning system; the system is mainly electricity consuming and includes a heat pump eventually coupled to a double heat storage and an auxiliary boiler. Hot or cold water is produced when the system efficiency is optimal or when the cost of electricity is reduced (night rate hours). The WAPITI algorithm determines a fixed electrical cost control while the WALLABY algorithm gives the optimal control strategy. An application for an office building is given.

48688 **(IEE—8705) Analysis of results of energy demand of 1st half of 1987 (fiscal) and prospect for 1988 (fiscal). Is the rapid demand growth in 1st half true?.** Sagawa, Naoto; Tachino, Kunio. (Institute of Energy Economics, Tokyo (Japan)). 25 Dec 1987. 40p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753446/JAW.

Energy consumption in the 1st half of 1987 (fiscal) was an increase of 3.2% to the previous year, the growth of the industrial energy was 3.0%. Energy for private use raised its bottom by meteorological factors such as fine weather and hot temperature. Trans-

portation use also increased corresponding to brisk goods distribution in response with the recovery of business (+2.9% to the previous year). Low level of actual energy price also contributed to the increase of consumption. Economic prospect is strong until the 1st. half of 1988. However, the leading factor of business is public consumption and public capital spending. Since after 1989, domestic market will be firm, but GNP growth will be at 3% level because of export decrease and import increase. Energy demand in 1988 will be at the level of 4.65x100 million kl as crude oil among which the primary energy of oil will occupy the share of 55.4%. C-oil will greatly grow in 1988, but will be horizontal from 1989. (32 figs, 17 tabs)

48689 **(NP—8770293) Study planning an energy model for the Saar region.** (Bundesforschungsanstalt fuer Landeskunde und Raumordnung, Bonn (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Biologie, Oekologie, Energie). 1987. 211p. (In German). NTIS (US Sales Only), PC A10. Order Number DE88770293/JAW.

The study intends to work out an energy model based on guided energy sources such as natural gas, district heat and electric power as well as on the economic energy conservation potential and other heating oil substitutes. The model is made to suit the requirements of the low-temperature heat supply of the highly industrialized and densely populated junction of the Dillingen - Voelklingen - Saarbruecken - Neunkirchen - Homburg axis. Apart from determining the low-temperature heat potential along with the relevant supplies the study discusses the convenient interaction of electric power, natural gas and district heat, the latter of which is being related to cogeneration and industrial waste heat utilization. Feasible ways of energy recovery combined with a minimization of the environmental load are another point of discussion. Priority is given to a safe and economic energy supply as well as to energy conservation. Both planning aspects and ecological aspects are taken into account. Emphasis is on long-term economy, governmental conditions and enterprise aspects. The Saar study aims at supporting the future planning and further development of supply structures. The principle it is based on advocates the maintenance of a competition of substitutes and free choice of energy sources to the interest of all users.

48690 **(NP—8770310) Heat supply concept for the planning region Southeast Upper Bavaria.** (Bundesforschungsanstalt fuer Landeskunde und Raumordnung, Bonn (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Biologie, Oekologie, Energie). 1987. 316p. (In German). NTIS (US Sales Only), PC A14. Order Number DE88770310/JAW.

The study aims at investigating into the feasibility of energy conservation in sparsely settled rural areas. Emphasis is on three types of areas typical of the region, namely rural industrial districts, tourist districts of mean heat densities, and rural areas as such. Alternative supplies and the present and future conditions required to realise them are opposed to the respective existing supplies. The study discusses the following subjects: Structure and analysis of the energy demand of Southeast Upper Bavaria, energy supply and analysis of supplies, selection of model communities, detailed data acquisition for 7 model communities in 3 model districts, development and evaluation of possible subconcepts improving the structure of space heating and strategies allowing for the realization of selected models aiming at the improvement of supply structures.

48691 **(NP—8770373) Regional energy supply concept model community Soerup.** Petersen, H.; Loebbecke, W.; Waehnert, H. (Bundesforschungsanstalt fuer Landeskunde und Raumordnung, Bonn (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Biologie, Oekologie, Energie). 1987. 100p. (In German). NTIS (US Sales Only), PC A05. Order Number DE88770373/JAW.

The community of Soerup in the district of Schleswig-Flensburg is, according to the Regional Plan V of the State of Schleswig-Holstein, 'a rural central place'. The model investigation was conceptualized to check the technical, economical and town-planning-related possibilities of the most important forms of thermal energy supply adapted to rural needs in adjustment to 'passive' measures of heat demand reduction and under consideration of market-economical viewpoints. The review of the possibility of transferring Danish experiences with rural energy supply concepts will be of some importance. The aim of the model investigation is to set up an energy supply concept for the Soerup type of village which is methodically transferable. Several variants are scrutinized, taking also into consideration the energy potentials that exist in the village and in its surroundings (energy saving, biomass, etc.). Furthermore, the possibilities of rational energy utilization are investigated with consideration of communal and private development planning.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 48146, 48147, 48148, 48348, 48381, 48382, 48387, 48684, 48708, 48709, 48716, 48717, 48724, 48747, 48748, 48750, 48751, 48757, 48761, 48784, 48845, 48846, 48873, 48899, 48900, 48917, 49617, 50274, 50296

48692 **(AD-A—194061/8/XAB) Risoe National Laboratory Systems Analysis Department. Annual progress report for 1987.** Fuller, E.C.; Larsen, H.; Mackenzie, G.A. (Risoe National Lab., Roskilde (Denmark)). Mar 1988. 29p. (RISOE-R—553). NTIS, PC A03/MF A01.

The report describes the work of the Systems Analysis Department at Riso National Laboratory during 1987. The activities may be classified as energy-systems analysis and risk and reliability analysis. The report includes a list of staff members.

48693 **(CMHC—091982) Data base of energy price structures for CMHC-2.** Tremayne, M.A. (Canada Mortgage and Housing Corp., Ottawa, Ontario). Sep 1982. 24p. (CE—01722). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents a data base of energy price structures for the CMHC-2 computer program. The objective is to provide an accurate energy-price-data base for the 61 locations across Canada which are available in the CMHC-2 computer program. The data base contained in the first four appendices provides a provisional framework which can be rapidly implemented and updated. An update is provided in a slightly different format as of January 1983, and indicates the dynamic nature of the pricing policy. 4 tabs.

48694 **(DOE/CE/64616—T2) Utah Energy Office: Tier I final report.** (Utah Energy Office, Salt Lake City (USA)). 31 Mar 1988. Contract FG01-86CE64616. 108p. NTIS, PC A06. Order Number DE88013216/JAW.

The US Department of Energy in its final report entitled "An Evaluation of the Institution Conservation Program" (ICP) states that the purpose of the ICP is "to help participating institutions save energy and reduce energy related costs" and "to conserve oil and thereby reduce the nation's dependence on imported fuels." As of 1986, no other states or the federal government had studied the long term savings attributable to ICP funded energy conservation measures (ECMs). This study endeavors to determine if the long term energy savings estimates and expectations of the ICP-assisted institutions, the state energy offices, and the federal government are being met in the states of Utah and Idaho. 3 tabs.

48695 **(NP—8770376) Financial aids in the fields energy conservation, rational energy use, new energy technology. As of January 1988. 6. Ed.** (Bayerisches Staatsministerium fuer Wirtschaft und Verkehr, Muenchen (Germany, F.R.)). 1988. 29p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770376/JAW.

The present low price level of energy should not lead to the temptation of being generous or even extravagant with the limited commodity 'energy'. Rational and economical use of energy is indispensable for ensuring our energy supply, for preserving the limited energy reserves and our environment. The Bavarian State Government supports sensible measures for rational energy output and use. For this, state aid is given where the market powers are not alone sufficient. This brochure, which is now published in 6th edi-

tion, offers a review of the existing possibilites of promotion at EC, state and land level. It offers information for all those wishing to save energy and is intended to contribute to the fact that meaningful investment in energy policy, and innovations can be more easily achieved, using all financial aids to the full.

48696 **(SAND—88-7088C) Progress in direct coal liquefaction: The economic perspective.** Gray, D.; Tomlinson, G. (Mitre Corp., McLean, VA (USA)). 1988. Contract AC04-76DP00789. 11p. (CONF-880912—10). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88011686/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

The economic impact of demonstrated and projected improvements in two-stage direct coal liquefaction processes are evaluated. The computerized methodology employed estimates the quantity and quality of products from a 30,000 ton/day commercial scale plant, based on input test data. Steam, hydrogen and fuel gas balances are determined. Capital and operating costs are then estimated, and the required selling price of raw liquid products is determined by conventional discounted cash flow (DCF) analysis. Product quality is quantified by computing the cost of upgrading the raw products to motor gasoline. This report also compares the economics of two-stage processing with earlier studies of the H-Coal, Exxon Donor Solvent and Lummus ITSL processes. The high costs of coal liquids found in these earlier studies are explained and revised costs for these earlier studies are explained and revised costs for these earlier plants using a common financial and technical basis are determined. 11 refs., 4 tabs.

48697 **(STC—8014086) State technology development programs in the South.** (Southern Technology Council, Research Triangle Park, NC (USA)). Dec 1987. 61p. Unlimited audience, publicly available. Southern Technology Council, P.O. Box 12293, Research Triangle Park, North Carolina 27709. Order Number TI88014086/JAW.

The intent of this publication is to provide a current compendium of programs and activities underway in the twelve states that comprise the Southern Technology Council. This is not the first attempt to gather such information, or will it be the last. Four years ago the Office of Technology Assessment compiled data on state technology development programs, more recently the Council of State Governments produced a matrix of state activities, and currently the National Governors' Association is assembling more detailed information. But because the Council represents those in the states who either operate or are most knowledgeable of state programs, it may be in the best position to ensure timely and accurate information.

48698 **(WHC-SA—0277) Career opportunities in mechanical engineering.** Carteret, B.A. (Westinghouse Hanford Co., Richland, WA (USA)). Mar 1988. Contract AC06-87RL10930. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013666/JAW.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 48086, 48137, 48245, 48358, 48359, 48381, 48383, 48403, 48877, 48902, 48918, 48923, 49512, 49514, 49547, 49549, 49573, 49574, 49596, 49615, 49616, 49617, 49618, 49619, 49620, 49621, 49622, 49624, 49713

48699 **(AD-A—193793/7/XAB) Advanced-development waste-processing unit for combat vehicles. Phase 2. Final report, 1 September 1986-31 January 1987.** Lord, C.K. (Otis Engineering, Sedalia, CO (USA)). 29 Dec 1987. 72p. NTIS, PC A04/MF A01.

The work performed under Phase II of this contract has resulted in the design and fabrication of a system capable of the efficient disposal of human waste from within a combat vehicle operating in an NBC environment with minimum impact to the vehicle or to the personnel operating within that vehicle. The Waste Processing Unit (WPU) has been demonstrated both by analysis and testing. The WPU for combat vehicle is currently undergoing further testing at Aberdeen Proving Grounds. Additionally, a modified version of the WPU was fabricated and tested to verify the feasibility of adapting the concept to marine applications. This effort has proven the feasibility of the application, and appears to have significant commercial possibilities.

48700 **(NP—8770388) Impact of economic and technological development on the pollution of the environment. Feasibility study.** Angerer, G.; Bischof, J.; Boehm, E.; Hohmeyer, O.; Jochem, E.; Kunz, P.; Pilhar, R.; Schoen, M. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). May 1986. 195p. (In German). NTIS (US Sales Only), PC A09. Order Number DE88770388/JAW.

The impact of the growth of the German national economy and the structural and technological changes taking place on the pollution of our natural environment are today still mostly unknown. The objective of this feasibility study was to find out if reliable results can be expected from a research project with this topic. The precondition for generating quantitative coherences between the development of the environment pollution which has started and the economic and technologic development of the national economy is the availability of representative time series over long years relating to indicators of environment pollution (e.g. immission, emissions). A review of the data revealed that this is only the case of the environment media air, surface waters, sediments and, with some restrictions, ground water. A result-oriented main investigation is, with some restrictions, estimated to be feasible. The results will not be able to give us a complete picture of the reciprocity of economic growth and environment pollution; it will be possible, however, for some important environment media, to derive reliable statements about the impact of economic activity and technological changes on partial pollutions. (orig./HSCH).

48701 **(ORNL—6450/R7) Environmental sciences division: Environmental regulatory update table July 1988.** Langston, M.E.; Nikbakht, A.; Salk, M.S. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 129p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88015323/JAW.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

48702 **(PB—88-219175/XAB) International information-exchange activities on dioxins.** Kutz, F.W.; Bottimore, D.P.; Bretthauer, E.W.; McNelis, D.N. (Versar, Inc., Springfield, VA (USA)). 1988. 10p. NTIS, PC A02/MF A01.

A project promoting the exchange of information on polychlorinated dibenzo-p-dioxins and related chemicals was initiated on an international basis. The project is being conducted under the auspices of the Committee on the Challenges of Modern Society of the North Atlantic Treaty Organization with representation from the following nations; Canada, Denmark, Federal Republic of Germany, Italy, Netherlands, Norway, United Kingdom, and United States. Areas being studied include exposure and hazard assessment, technology assessment, and management of accidents.

48703 **(PB—88-219951/XAB) Progress in environmental specimen banking. Special pub. (Final).** Wise, S.A.; Zeisler, R.; Goldstein, G.M. (National Bureau of Standards, Washington, DC (USA). Center for Analytical Chemistry). Apr 1988. 221p. (NBS/SP—740). NTIS, PC A10/MF A01.

Also available from Supt. of Docs. as SN003-003-02868-1; Library of Congress catalog card no. 88-600530.

In the past decade, interest in the concept of specimen banking for the archiving of biological and environmental samples for future analysis has increased significantly, and specimen banking is now recognized as an integral part of systematic environmental monitoring. In recent years representatives of similar programs in

Japan, Canada, and Sweden have joined in these meetings to expand the exchange of information. The 10th U.S.-German Seminar of State and Planning on Environmental Specimen Banking was held. At the meeting the current status of specimen banking activities in the U.S., FRG, Canada, and Japan was presented and discussed. The publication contains the proceedings of that meeting with contributions describing various activities related to banking and analysis of samples from aquatic, atmospheric, terrestrial, and human monitoring programs.

48704 **(PB—88-866231/XAB) Pollution liability. January 1970-June 1988 (Citations from Pollution Abstracts). Report for January 1970-June 1988.** (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 51p. NTIS PC N01/MF N01.

Supersedes PB—87-861431.

This bibliography contains citations concerning court decisions regarding pollution liability. Specific aspects of pollution legislation that must be proven to establish liability are discussed. Federal, state, or civil exemptions to pollution laws are detailed. Pollution liability insurance is examined. Punitive assessments providing economic recovery and clean up costs to injured parties are briefly considered. Specific court decisions are used to highlight general principles of pollution liability. (This updated bibliography contains 149 citations, 10 of which are new entries to the previous edition.)

48705 **(PB—88-914300/XAB) Hazardous-waste Data Management System (HWDMS) facility location extract tape. Data files.** (Environmental Protection Agency, Washington, DC (USA). Office of Policy, Planning and Evaluation). 1988. mag tap. NTIS Subscription.

See also PB—88-913800 and PB—88-913801; Source tape is in the EBCDIC character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. For price at 6250 bpi density, call NTIS Computer Products. Available on subscription, North American Continent price $800.00/year; individual issue $200.00; all others write for quote. Issued quarterly.

The file contains data on hazardous-waste handlers, and/or generators, that are stored in the Hazardous Waste Data Base (HWDMS). The information is compiled from the notification of Hazardous Waste Activity, EPA Form 8700-1, and Forms 3510-3, Application for Hazardous Waste Permits. The data includes names and addresses as well as locational information for all notifying Treatment, Storage, and Disposal (TSD) Facilities, as well as for all notifying generators of at least 1000 KG/MO of non-active hazardous wastes or 1 KG/MO of acute hazardous wastes. EPA does not claim that HWDMS contains all the potential regulated hazardous-waste facilities that exist or will exist. Although the property in which you are interested is not currently listed in the data base, this is not a guarantee that a hazardous waste problem will not exist there.

48706 **(PNL-SA—15747) Selecting accidents for evaluating significant adverse environmental impacts.** Howes, B. W. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1988. Contract AC06-76RL01830. 7p. (CONF-880601—43). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014751/JAW.

From American Nuclear Society annual meeting; San Diego, CA, USA (12 Jun 1988).

"Reasonably foreseeable significant adverse impacts" must be evaluated by federal agencies when preparing environmental impact statements for major federal action. As part of that evaluation process, agencies must address potential environmental impacts associated with accidents that might occur during either the construction or operational phase of the proposed project. This paper describes how accidents may be selected for consequence analysis and, when information is unavailable, how the "rule of reason" approach can be applied to low-probability/high-consequence events. 2 refs.

48707 **Preparation of material safety data sheets.** Lu, P.Y.; Ensminger, J.T. (Information Research and Analysis, Oak Ridge National Lab., Oak Ridge, TN (US)). pp 559 of 1986 hazardous material spills conference proceedings: Preparedness, prevention, control and cleanup of releases. Ludwigson, J. Rockville, MD; Government Institutes Inc. (1986). (CONF-8605256—).

From Hazardous material spills conference: preparedness, prevention, control and cleanup of releases; St. Louis, MO, USA (5 May 1986).

In order to provide reliable chemical safety information to the employees of Martin Marietta Energy Systems, Inc. (Energy Systems), the Information Research and Analysis (IR and A) Group of the Oak Ridge National Laboratory, in collaboration with Energy Systems industrial hygiene personnel, has developed a computerized information system for Material Safety Data Sheets (MSDS). This discussion focuses on the preparation of Material Safety Data Sheets (MSDS) that might be of use for those who are involved in the implementation of the Right-to-Know Law. The following topics are discussed in detail. Chemical identification/prioritization; Information Resource, In-house databases, and MSDS provided by manufacturers/others; Computer information input/output; Peer review to assure quality; and Information retrieval/distribution. Thus far, more than 5,000 chemical substances have been cataloged in the MSDS information system. MSDS for about 1,400 top priority compounds have been completely prepared.

2904 Natural Resources

REFER ALSO TO CITATION(S) 48084, 48085, 48086, 48087, 48348, 48381, 48382, 48894, 49570

48708 **(PB—88-210752/XAB) Changing role of the nonfuel mineral industry in the state and local economies of Arizona (1981-1986).** Opyrchal, A.M.; Swisko, G.M.; Adams, R.L. (Bureau of Mines, Washington, DC (USA)). Apr 1988. 45p. (BM-OFR—30-88). NTIS, PC A03/MF A01.

The Bureau of Mines is currently analyzing the impacts of changes in nonfuel mineral industry activity upon regional economies. As part of the project the Bureau examined the impacts on Arizona and four of its counties resulting from significant changes in nonfuel mineral production between 1981 and 1986. Regional input-output models for Arizona and the counties of Gila, Greenlee, Pima, and Pinal were developed through IMPLAN, the U.S. Forest Service's economic impact model. These models generated multipliers to measure total impacts of changes in activity on employment, earnings, and indirect business taxes. From 1981 to 1983 metallic nonfuel mineral production in Arizona declined significantly. Findings show that county economies are quite sensitive to changes in nonfuel mineral production.

48709 **(PB—88-210919/XAB) Role of nonfuel minerals in the nevada state economy and the counties of Elko, Eureka, Lander, Nye, and White Pine. Report for 1981-1986.** Swisko, G.M. (Bureau of Mines, Washington, DC (USA)). Dec 1987. 55p. (BM-OFR—23-88). NTIS, PC A04/MF A01.

The Bureau of Land Management examined the impacts on Nevada and several of its counties resulting from significant changes in nonfuel mineral production between 1981 and 1986. Regional input-output models for Nevada and the counties of Elko, Eureka, Lander, Nye, and White Pine were developed through IMPLAN, the U.S. Forest Service's economic impact model. From 1981 to 1986 gold and silver production in Nevada grew at a faster rate than the total production of all goods and services measured by the gross state product. Other nonfuel mineral production however declined, with direct employment and earnings losses offsetting the employment and earnings gains from increased gold and silver mining. These changes also generated indirect impacts on employment and earnings for other industries, which varied for each region according to population, industrial diversification, and the types of minerals mined. Findings show that several county economies are quite sensitive to changes in nonfuel mineral production.

48710 (PB—88-218920/XAB) Forest growth modelling and prediction. Volume 1. Forest Service general technical report. Ek, A.R.; Shifley, S.R.; Burk, T.E. (Forest Service, St. Paul, MN (USA). North Central Forest Experiment Station). 1988. 596p. (FSGTR-NC—120-VOL-1). NTIS, PC A25/MF A01.

See also Volume 2, PB—88-218938.

This publication documents the proceedings of the Forest Growth Modelling and Prediction Conference sponsored by the International Union of Forestry Research Organizations in Minneapolis, Minnesota, USA, August 23-27, 1987. During the conference, 130 papers and 27 poster-papers were presented. They covered all types of tree and forest-growth modelling methodology, including theory, parameter estimation, and evaluation of models; incorporation of silvicultural treatments, weather, and other environmental perturbations; regeneration; design of growth studies; and application of growth models in research and management. Presentations covered tropical, temperate, and boreal forest regions.

48711 (PB—88-218938/XAB) Forest growth modelling and prediction. Volume 2. Forest Service general technical report. Ek, A.R.; Shifley, S.R.; Burk, T.E. (Forest Service, St. Paul, MN (USA). North Central Forest Experiment Station). 1988. 583p. (FSGTR-NC—120-VOL-2). NTIS, PC A25/MF A01.

See also Volume 1, PB—88-218920.

Contents include: Self-thinning and density management; Estimation techniques; Evaluation and validation of models; Management applications and optimization techniques; Simulation system and model overviews; Modelling taper, biomass, and product quality; Inventory, study designs, and data bases; and Abstracts of additional presentations.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 48291, 48338, 48356, 48371, 48697, 48815

48712 (CONF-880210—3) Technology transfer at Argonne National Laboratory. Frost, R.T.; Besio, G.J. (Argonne National Lab., IL (USA); ARCH Development Corp., Argonne, IL (USA)). 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012062/JAW.

From 1. world congress on superconductivity; Houston, TX, USA (22 Feb 1988).

The Technology Transfer Center is industry's pathway to Argonne. Through the Center, Argonne has established a number of prototype programs for forging alliances with industry, providing leadership among the national laboratories. Argonne has in place programs for cooperative research and development, industrial residencies and staff exchanges, post doctoral appointments, contract research, patent licensing and joint ventures through the ARCH Development Corporation, research consortia, and educational outreach initiatives. Each of these programs is described briefly, with examples cited to illustrate implementation. All programs are relevant to the commercialization of superconductor technologies developed at Argonne.

48713 (CONF-880814—4) Military EMCS [energy monitoring and control systems]: Implications for utilities, cities, and energy services. MacDonald, M.; Gettings, M.B. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014555/JAW.

From Summer study on energy efficiency in buildings; Pacific Grove, CA, USA (28 Aug 1988).

This paper discusses possible extensions of energy monitoring and control systems (EMCS) to a high level control for many buildings over a large area (large scale EMCS). Extensions of current EMCS approaches appear to be emerging technologies. Initial awareness of possibilities for such extensions was generated as a result of study conducted on the effectiveness of EMCS used by the US Army. Further interest was generated upon learning about other systems that make use of extended control to many buildings over a large area. An overview of certain factors that appear to have an impact for the large scale EMCS concept, limited trend data available on energy and cost savings for the military systems that were evaluated, operational and maintenance considerations that impact use of the large scale EMCS, a discussion of some implications for potential future use of large scale EMCS, and recommendations for possible future work on study and implementation of such systems are presented. The concept of large scale EMCS offers important challenges and opportunities for utilities, cities, and energy services to advance the art and science of building energy and comfort control. We hope the large scale EMCS concept can lead to useful, real applications that provide benefits for many people and organizations. Significant benefits appear possible for extensions of present EMCS technologies, and significant work is needed to understand and promote these potential benefits. 20 refs., 4 figs.

48714 (CONF-8705296—) Fermilab Industrial Affiliates roundtable on research technology in the twenty-first century. Carrigan, R.A. Jr.; Fenner, R.B. (eds.). (Fermi National Accelerator Lab., Batavia, IL (USA)). May 1987. Contract AC02-76CH03000. 186p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88012071/JAW.

From 7. annual meeting of the Fermilab Industrial Affiliates on research technology in the twenty-first century; Batavia, IL, USA (21 May 1987).

This collection of articles presents views on the future of physics research by leading experts in the field. Topics discussed include particle physics, the Superconducting Super Collider, and the development of new superconducting materials. The articles have been abstracted and indexed separately.

48715 (DOE/ER—0144/6) Summaries of FY 1988 research in the chemical sciences. (USDOE Office of Energy Research, Washington, DC; USDOE Office of Scientific and Technical Information, Oak Ridge, TN). Sep 1988. 125p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88010147/JAW.

This summary book is published annually to provide information on research supported by the Department of Energy's Division of Chemical Sciences, which is one of six Divisions of the Office of Basic Energy Sciences in the Office of Energy Research. These summaries provide the scientific and technical public, as well as the legislative and executive branches of the Government, information, either generally or in some depth, about the Chemical Sciences program. Areas of research supported are indicated in the section headings, the "Selected Topics of General Interest" list, and the summaries themselves. Energy technologies that may be advanced by use of the basic knowledge generated in this program are included in the "Selected Topics of General Interest" list and are often referenced in the summaries. A separate section of this publication includes summaries of projects funded during FY 1988 by the Small Business Innovation Research (SBIR) Program Office in response to technical topics submitted by the Division of Chemical Sciences to the annual SBIR Solicitation.

48716 (EMR/E—BERD-8501) Federal energy research and development, summary of achievements, 1975-1984. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Energy Sector). 1984. 50p. (CE—01753). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This summary is intended to provide an overview of the major achievements of the activity coordinated by the Canadian Federal Panel on Energy Research and Development, 1975-84. The items in this summary are a selection of those projects which have to date yielded results which have been implemented by industry or by government agencies responsible fo regulation, policy, or provision of services. In areas of fundamental research, basic advances in knowledge or the establishment of research facilities are identified. The majority of these achievements are in programs dealing with the shorter term and often having the advantage of established industries and markets, such as in energy conservation and in oil and gas. Commercial implementation of the results of medium to longer-term research programs such as in coal liquefaction, active solar, fusion and hydrogen can take much longer. The report is

classified by task and program objectives, in the following areas: energy conservation; oil sands/heavy oils, coal supply and combustion; nuclear fusion; renewable energy; new liquid fuels; oil, gas, and electricity; and coordination and generic environment issues.

48717 **(EMR/E—BRDE-8501) Federal energy research and development, summary of achievements, 1975-1984.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Energy Sector). 1984. 61p. (In French). (CE—01754). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This summary is intended to provide an overview of the major achievements of the activity coordinated by the Canadian Federal Panel on Energy Research and Development, 1975-84. The items in this summary are a selection of those projects which have to date yielded results which have been implemented by industry or by government agencies responsible fo regulation, policy, or provision of services. In areas of fundamental research, basic advances in knowledge or the establishment of research facilities are identified. The majority of these achievements are in programs dealing with the shorter term and often having the advantage of established industries and markets, such as in energy conservation and in oil and gas. Commercial implementation of the results of medium to longer-term research programs such as in coal liquefaction, active solar, fusion and hydrogen can take much longer. The report is classified by task and program objectives, in the following areas: energy conservation; oil sands/heavy oils, coal supply and combustion; nuclear fusion; renewable energy; new liquid fuels; oil, gas, and electricity; and coordination and generic environment issues.

48718 **(EPRI-EM—4527-Rev.1) Electrotechnology reference guide: Revision 1, Final report.** (Electric Power Research Inst., Palo Alto, CA (USA); Resource Dynamics Corp., McLean, VA (USA)). Aug 1988. 183p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016086/JAW.

This revised edition of the Electrotechnology Reference Guide has been developed to help utilities better understand the needs of their industrial customers that can best be served by the application of electrotechnologies. For the first time, this edition includes equipment suppliers to help identify the manufacturers of each technology. The underlying analyses within the Guide show that significant opportunities now exist for electrotechnology applications, specifically those associated with process heating and motor drives. The formate of the Guide (i.e., industry analysis, electrotechnology analysis, and end-use applications analysis) represents a framework that utilities can use to assist their customers in improving efficiency, productivity and product quality. Projections of electricity consumption by electrotechnology for the years 1990 and 2000 are included to help utility planners estimate their impact on future operations. In addition, analyses of industrial natural gas consumption and gas end-use applications are included to assist utility competitive assessments. 84 refs, 17 figs, 17 tabs.

48719 **(LA—11173-MS) Directed energy concepts for strategic defense.** Canavan, G.H. (Los Alamos National Lab., NM (USA)). Jun 1988. Contract W-7405-ENG-36. 70p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015050/JAW.

Directed energy concepts can play unique roles in strategic defense because of their reaction time, speed of light engagement, and large geographic coverage. This report discusses the main directed energy concepts, engagements in which they could have significant leverage, and their expected performance in them. It covers both boost phase engagements and midcourse applications, and contrasts these results with those of earlier analyses. 82 refs., 4 figs.

48720 **(LA—11322-MS) SDI [Strategic Defense Initiative]: Myth or reality?.** Canavan, G.H. (Los Alamos National Lab., NM (USA)). Jun 1988. Contract W-7405-ENG-36. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015059/JAW.

This report reviews previous attempts to develop strategic defenses, the technologies currently under consideration by the Strategic Defense Initiative (SDI), their main unknowns, and the likely performance of strategic defense concepts against evolving threats. 47 refs.

48721 **(LA—11344-MS) Military uses of space.** Canavan, G.H. (Los Alamos National Lab., NM (USA)). Aug 1988. Contract W-7405-ENG-36. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015053/JAW.

This report reviews the information gathering, offensive, and defensive uses of space. The report concludes that, while all defensive uses are likely to grow, the most important ones are warning, verification target relocation, and defense. 21 refs.

48722 **(NP—8770360) Systems analysis and technology assessment.** (Arbeitsgemeinschaft der Grossforschungseinrichtungen (AGF), Bonn (Germany, F.R.)). 1987. 51p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88770360/JAW.

The brochure here is intended to give an impression multiplicity of systems analysis treatises in large-scale research establishments. In the individual chapters, the methodical estimations and the results of selected studies in the fields of energy, traffic, information and communications, as wells a environment and health are presented. The closing chapter offers a survey on the aims, working emphasis and potential of various systems analysis groups.

48723 **(ORNL/M—577) Building Thermal Envelope Systems and Materials (BTESM) and research utilization/technology transfer progress report for DOE Office of buildings and community systems: Monthly progress report.** Samples, S.D.; Coleman, G.L. (comps.). (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015325/JAW.

The Monthly Report of the Building Thermal Envelope Systems and Materials (BTESM) Program is a monthly update of both in-house ORNL projects and subcontract activities in the research areas of building materials, wall systems, foundations, roofs, building diagnostics, and research utilization and technology transfer. Presentations are not stand-alone paragraphs every month. Their principal values are the short-time lapse between accomplishment and reporting, and their evolution over a period of several months.

48724 **(PB—88-209341/XAB) Multi-criteria analysis and budget allocation, with applications in energy R and D planning a feasibility study.** Lootsma, F.A.; Mensch, T.C.A.; Vos, F.A. (Technische Hogeschool Delft (Netherlands). Onderafdeling der Wiskunde en Informatica). 1988. 72p. (REPT—88-07). NTIS, PC E04/MF A01.

See also PB—84-216563.

The report presents the results of a feasibility study conducted to the order of the Commission of the European Communities (Directorate-General for Science, Research, and Development). A method of pair-wise comparisons was used to rank and rate a number of non-nuclear energy research programs under the relevant criteria. The final scores of the programs were employed to calculate an optimal reallocation of the research budget, assuming that there is only a small number of distinct support levels for each program.

48725 **(PB—88-219852/XAB) National Science Foundation annual report, 1987.** (National Science Foundation, Washington, DC (USA)). Jun 1988. 116p. (NSF—88-1). NTIS, PC A06.

Also available from Supt. of Docs. See also report for 1986, PB—87-228375; Color illustrations reproduced in black and white.

The National Science Foundation is an independent federal agency created by the National Science Foundation Act of 1950 (P.L. 81-507). Its aim is to promote and advance scientific progress in the United States. The idea of such a foundation was an outgrowth of the important contributions made by science and technology during World War II. From those first days, NSF has had a unique place in the federal government: it is responsible for the overall health of science and engineering across all disciplines. In contrast, other federal agencies support research focused on specific

missions, such as health or defense. The Foundation is also committed to expanding the nation's supply of scientists, engineers, and science educators. The document summarizes the Annual Report for Fiscal Year 1987 of the National Science Foundation.

48726 **(PNL—6500-Pt.2) Pacific Northwest Laboratory annual report for 1987 to the DOE office of energy research: Part 2, Environmental sciences.** (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88016153/JAW.

This report summarizes progress in environmental sciences research conducted by Pacific Northwest Laboratory (PNL) for the Office of Health and Environmental Research in FY 1987. Research is directed toward developing a fundamental understanding of processes controlling the long-term fate and biological effects of fugitive chemicals and other stressors resulting from energy development. The research, focused on terrestrial, subsurface, and coastal marine systems, forms the basis for defining and quantifying processes that affect humans and the environment at the regional and global levels. Research is multidisciplinary and multitiered, providing integrated system-level insights into critical environmental processes. Research initiatives in subsurface microbiology and transport, global change, radon, and molecular sciences are building on PNL technical strengths in biogeochemistry, hydrodynamics, molecular biology, and theoretical ecology. Unique PNL facilities are used to probe multiple phenomena complex relationships at increasing levels of complexity. Intermediate-scale experimental systems are used to examine arid land watershed dynamics, aerosol behavior and effects, and multidimensional subsurface transport. In addition, field laboratories (the National Environmental Research Park and Marine Research Laboratory) are used in conjunction with advanced measurement techniques to validate concepts and models, and to extrapolate the results to the system and global levels. Strong university liaisons now in existence are being markedly expanded so that PNL resources and the specialized technical capabilities in the university community can be more efficiently integrated.

48727 **(PNL-SA—15772) Prospecting for intellectual capital.** Watts, R.L.; Levinson, T.M. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 9p. (CONF-8806188—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014076/JAW.

From 13. international symposium on technology transfer and annual meeting of the Technology Transfer Society; Portland, OR, USA (29 Jun 1988).

Many nations have become aware of the importance of new technical developments in maintaining/regaining a competitive edge in the world marketplace. There are many national, state and local programs designed to reduce the time required to move new technology from the laboratory to the marketplace. These programs tend either to emphasize research or to assist entrepreneurs. Less emphasis appears to be placed on programs that encourage the development of intellectual capital (innovative inventions) that result from applying research discoveries in materials, electronics, optics, sensors, etc., to solve energy conservation problems and improve industrial productivity. A uniquely successful US Department of Energy (DOE) program in the Office of Energy Utilization Research (located in the Office of Conservation) is exploring methods of encouraging innovative invention. This "invention laboratory," called the Innovative Concepts Program, applies cost-effective methods to encourage the process by which scientifically sound ideas are turned into innovative energy-saving concepts, i.e., intellectual capital. This paper briefly describes that "invention laboratory," its methods and the very encouraging results attained to date. 3 figs., 3 tabs.

48728 **(SAND—87-1651) Contracting in the national interest: Establishing the legal framework for the interaction of science, government, and industry at a nuclear weapons laboratory.** Furman, N.S. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1988. Contract AC04-76DP00789. 24p. NTIS, PC A03. Order Number DE88015410/JAW.

Sandia National Laboratories, the nation's nuclear ordnance laboratory, is operated on a no-profit, no-fee basis by AT&T Technologies, Inc., as a prime contractor for the Department of Energy. This unique arrangement began in 1949 when President Harry Truman personally requested that AT&T assume management of the nuclear weapons laboratory as a service in the national interest. The story of how this unusual relationship came about makes for an interesting chapter in the annals of US legal and institutional history. This report describes the historical background, political negotiations, and prime contract provisos that established the legal framework for the Labs.

48729 **(SAND—88-0984) Sandia National Laboratories: A product of postwar readiness, 1945-1950.** Furman, N.S. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1988. Contract AC04-76DP00789. 24p. NTIS, PC A03. Order Number DE88015414/JAW.

The genesis and growth of Sandia National Laboratories, the nation's largest nuclear weapons lab, stands as a pertinent case study showing the oftentimes complex, but effective interaction of government, industry, and the growth of cooperative research. Originally a part of Los Alamos Scientific Laboratory under management by the University of California, Sandia traces its roots to Z Division, an ordnance-engineering arm located at Sandia Base on the desert outskirts of Albuquerque, New Mexico, in September 1945. For Sandia National Laboratories, the early postwar years{emdash}rather than representing a transformation to peacetime{emdash}were characterized by a continued mobilization of engineering and science in the name of national readiness.

48730 **The U.S. Department of Energy Photovoltaic Program for 1987.** Prince, M.B. (U.S. Department of Energy, Washington, DC (USA)). pp 1185-1191 of Seventh E.C. photovoltaic solar energy conference. Goetzberger, A.; Palz, W.; Willeke, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1987). (CONF-861021—).

From 7. European photovoltaic solar energy conference; Sevilla, Spain (27 Oct 1986).

At the time of this writing (October 3, 1986) the budget for Fiscal Year 1987 has not yet been approved by the U.S. Congress. Based on preliminary information, it is expected that the Photovoltaic Program will receive approximately $35,000,000 for the period October 1, 1986 thru September 30, 1987. At this funding level, the major effort will be expanded on thin film research ($13 M), concentrator cell research ($4 M), and fundamental and supporting research ($5 M). The remaining funds will be used for crystalline silicon, flat plate modules, concentrator modules, system development, systems evaluation and program management. 1 ref., 4 tabs.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 48225, 48226, 48557, 48566, 48568, 49624, 49713

48731 **(AD-A—192999/1/XAB) Book analysis: the absolute weapon: atomic power and world order. Student report.** Homrig, M.A. (Air Command and Staff Coll., Maxwell AFB, AL (USA)). Apr 1988. 35p. (ACSC—88-1265). NTIS, PC A03/MF A01.

Bernard Brodie is one of the leading theorists from the golden age of nuclear strategy. His farsighted theories stated in The Absolute Weapon: Atomic Power and World Order, are as fresh today as when he wrote and edited the book in 1945. This paper scrutinizes four of the book's theories in relation to the historical record to confirm whether they continue to have merit as a guide for US nuclear policy. First, he clearly understood the need for a nuclear retaliatory force. Second, he believed low-intensity conflict forces would be required. Third, Brodie thought the superpowers could negotiate arms reductions but believed an arms race was just as likely. Fourth, he did not believe the Soviets would ever launch a surprise attack against the US.

48732 **(INIS-mf—11273) Final report of the tritium issues working group. Vol. 1.** Spratt, Peter; Hardy, David; Peirce, Denny; Smith, Ron; Wyatt, Alan. (Spratt (P.J.) and Associates Inc., Toronto, Ontario (Canada)). Sep 1985. 109p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88704025/JAW.

Early in 1985 the proposed sale of the isotope 'tritium' by Ontario Hydro became a public issue. A number of community groups claimed in public forum that tritium recovered from Ontario Hydro's nuclear reactors would be sold or diverted to American thermonuclear (fusion) weapons. Their position was based on the following presumptions: that tritium was a major component in American nuclear weapons, that the United States has a supply problem with or shortage of this material, and that Ontario Hydro would directly or indirectly support the American nuclear weapons program: a) by providing tritium directly to the U.S. Department of Energy for use in nuclear weapons, or b) by supplying tritium to certain buyers - either traditional commercial facilities or the developing fusion research agencies associated with the Department of Energy, thus allowing or making possible the diversion of this isotope to nuclear weapons purposes, or c) by answering the needs of the commercial market, at present supplied from production reactors dedicated to supplying U.S. military requirements, indirectly allowing the U.S. government to concentrate its efforts on the production of tritium for nuclear weapons. When members of what has become known as the 'Tritium Issues Working Group' were first approached by Dr. T.S. Drolet in mid-April 1985, we were asked if we would agree to participate in a study to assess whether Canadian tritium, which is to be produced only for commercial and research purposes, could be inadvertantly utilized, either directly or indirectly, in the American nuclear weapons program. Our discussion of these issues is covered in Volume 1 of this report and is supplemented by appropriate Appendices in Volume 2. We could find absolutely nothing of a factual nature to justify the hypothesis that Canadian tritium would find its way into the American weapons program.

48733 **(INIS-mf—11274) Final report of the tritium issues working group. Vol. 2. Appendices.** Spratt, Peter; Hardy, David; Peirce, Denny; Smith, Ron; Wyatt, Alan. (Spratt (P.J.) and Associates Inc., Toronto, Ontario (Canada)). Sep 1985. 111p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88704026/JAW.

This report consists of a series of appendices relating to the sociological and technical considerations of tritium and its related technology. It is intended as a supplement to Volume 1 of the Final Report of the Tritium Issues Working Group. The work will the cover the following specific areas: A) Development of an ethical framework related to technology, morality, weapons, politics, etc. B) Review the history of nuclear power in Canada, placement of this technology in context with other technologies, waste products and the CANDU reactor system. C) Assessment of tritium as a unique product, as a class of isotopes, waste by-product and physical properties, effects on human life and its place in the natural environment. D) Assessment of tritium and the environment, diffusion through commerical application, European and American experience, waste management and recycling. E) Assessment of commercial applications, including current experience, historical applications for commercial purposes, offshore revenue for Canada value-added component and role of Ontario Hydro. F) Assessment of tritium and weapons, including technology and the military, past and future role of tritium in weapons, proliferation theories, generic conclusions regarding linkages, dependence of Americans on foreign sources of strategic resources. G) Review of regulations in effect now with respect to nuclear and/or other products with potential to military application, and what is needed. H) Review of traditional Canadian postures in the area of technology perception and political culture, the role, mandate and responsibility of Ontario Hydro, growth of international economy, Canada's competitive position in this economy and the challenges and dilemmas that modern decision makers have in a highly interrelated technological world.

48734 **(INIS-mf—11727) Terminology standardisation in the nuclear engineering field. Lecture presented to a colloquium of the Institute of Nuclear Energetics and Energy Systems of Stuttgart University.** Kraut, A. (Hochschule der Bundeswehr Muenchen, Neubiberg (Germany, F.R.)). 27 Nov 1987. 20p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754651/JAW.

Terminological standardisation is made for the purpose of unambiguous understanding, at least among experts in a given field of knowledge. The author explains a number of criteria and aspects to be taken into account in the process of standardisation by referring to the work of the Terminology Committee on Nuclear Engineering. He discusses the word formation in a technical language and the features of standardised terminology. Accepted terminology is a main factor in all procedures concerning design, testing, and approval and licensing of nuclear facilities, and also is of importance in terms of economics.

48735 **(NUREG—0750-Vol.27-No.6) Nuclear Regulatory Commission issuances.** (Nuclear Regulatory Commission, Washington, DC (USA)). Jun 1988. 44p. NTIS, PC A03/MF A01 - GPO. Order Number TI88015475/JAW.

This report includes the issuances received during the specified period from the commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

48736 **(NUREG—1260-Vol.2) A report to Congress Nuclear Regulatory Research: Project descriptions for FY88.** (Nuclear Regulatory Commission, Washington, DC (USA)). Aug 1988. 732p. NTIS, PC A99/MF A01 - GPO. Order Number TI88015793/JAW.

This report has been written in response to a request of the United States Congress that the Nuclear Regulatory Commission prepare and submit to the Congress a summary description of its research projects. Commercial contracts and research efforts at the Department of Energy (DOE) laboratories are assigned a five-digit financial number (FIN). This report provides a project descriptions for each FIN number. The project descriptions are divided into five major sections called program areas. These areas are: integrity of reactor components, prevent damage to reactor cores, reactor containment safety, confirming safety of nuclear waste disposal, and resolving safety issues and developing regulations. An explanation of each program area is given in an overview at the beginning of each section.

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 48916, 48922, 48925

48737 (CONF-8403264—Exc., pp 1.7.1-1.7.11) **Oversupply capacities in an old-industrial agglomeration region.** Bartlomiej, J. 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

Using the example of the City of Gelsenkirchen (North-Rhine Westphalia, population 300,000) where 12% of the total coal mining of the Ruhr area is located, the article deals with the problems of expanding district heating and the situation of its competition with possible other sorts of energy (gas, waste heat, cogeneration plants) under cost-related aspects. It seems desirable to further expand district heating for economic and environmental protection reasons to substitute mineral oil, to save primary energy, and to reduce emission; the future expansion of district heating in Gelsenkirchen, however, depends strongly on public subsidies. Although sufficient heat would be available from existing plants, the high initial costs incurred until the network is completed cannot be justified from the viewpoint of operating efficiency. The conclusion is as follows: Despite existing overcapacities of heat generation plants, the economic goals can be achieved only by realizing the goals relating to operating efficiency. (PJH).

48738 **(EPRI-EM—5954) Small cogeneration system costs and performance: Final report.** Gerber, D.C. (Electric Power Research Inst., Palo Alto, CA (USA); Science Applications International Corp., San Diego, CA (USA)). Aug 1988. 177p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015243/JAW.

This study reports data gathered from 54 cogeneration sites on the reliability, performance and operating cost histories of the equipment at each site. In all cases the systems were smaller than 2 MW(e) output. Availability was used as the measure of reliability in this study. The variation of availability with the following seven characteristics was analyzed: engine speed, maintenance contract type, absorption chiller type, turbocharger type, operation mode, emissions controls and engine type. Availability variations by time in service were also calculated. In addition the data was analyzed to assess the causes of unscheduled outages. System shutdown statistics were gathered that attributed failure to one or more of 15 different subsystems. Data was also gathered on the electric and thermal efficiencies of the cogeneration system, system installed costs, maintenance costs, savings, payback periods, and ownership. Again the variation in these data with the six parameters listed above were analyzed. All of the data were entered into a database using the dBase III software and an IBM PC. 27 ref., 16 tables.

48739 **(NP—8770305) Modular cogeneration power plants - a solution for a decentralized energy supply?.** Weingarten, I.; Roth, B.; Fuchs, P. (Badenwerk A.G., Karlsruhe (Germany, F.R.)). 1987. 17p. (In German). NTIS (US Sales Only), PC A03. Order Number DE88770305/JAW.

In recent public discussions, the request for decentralising the energy supply was made frequently. This is to be achieved by numerous small gas- or oil-fired modular co-generation plants where power and heat can be generated with combustion engines with the highest possible degree of utilization of the fuel, at the very place of the need. It is said that this would help to save fuel for generating heat and power, and expensive district lines would become unnecessary. In principle, heat can be taken from any thermal power plant. The costs of this heat basically depend on the investment costs of the district heating lines and not so much on the fuel costs. Therefore, district heating is profitable only at places where a large number of consumers can participate in a small area, i.e. in densely populated areas. Due to the long distances between the power plants and the consumers, up to now only appr. 15% of the installed thermal power plant performance is used for heating purposes. The customer must be billed for the real cost of this district heat. Subsidizing through the power price is not reasonable. What contribution can be made by combined generation of power and heat in a modular co-generation plant - this is investigated in the following.

48740 **(NP—8770365) Survey on rational heat supply in low-temperature sphere with special consideration of the use of district heating in Lower Saxony. Vol. 2 and 7.** Brachetti, H.E.; Oest, W.; Schaffner, J.; Hof, M. von. (Fernwaerme-Forschungsinstitut in Hannover e.V., Hemmingen (Germany, F.R.); Institut fuer Angewandte Systemforschung und Prognose (ISP), Hannover (Germany, F.R.)). 1985. 231p. (In German). NTIS (US Sales Only), PC A11. Order Number DE88770365/JAW.

In these two volumes, possibilities for the future production of low-temperature heat in Lower Saxony are examined, examples for economical district heating supply are elucidated, and criteria for the promotion of district heating projects in Lower Saxony are interpreted. Finally, there follow a critical assessment and recommendations.

2910 Conservation

REFER ALSO TO CITATION(S) 48358, 48359, 48694, 48695, 48713, 48716, 48717, 48740, 48744, 48745, 48746, 48800, 48815, 48820, 48844, 48845, 48861, 48862, 48863, 48866, 48867, 48894, 48895, 48899, 48900, 48901, 48903, 48904, 48905, 48906, 48907, 48917, 48918

48741 **(DOE/PE—0084) Oil conservation potential in the US economy: A preliminary analysis of the opportunities for reducing US oil demand through efficiency improvements and fuel substitution.** (USDOE Assistant Secretary for Policy, Planning and Analysis, Washington, DC. Office of Policy Integration). Aug 1988. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015611/JAW.

This paper focuses on the technical potential to reduce oil use; as such, it is a "technical boundary analysis," not a cost effectiveness study. The changes required and the costs of achieving this oil conservation potential are considered only briefly and qualitatively. The costs and economic value of the oil savings must be analyzed in detail in order to make any judgment about whether achieving this potential is in the national or private interest. Much of the oil conservation potential discussed here is not likely to be cost-effective unless oil prices are higher than those in the DOE/EIA projections. The type of data required and the issues that must be covered in the cost/benefit analysis are described briefly in Appendix A. Work is underway within DOE to estimate some of the changes and costs required to achieve the oil demand reduction discussed in this analysis. 13 figs., 2 tabs.

48742 **(PB—88-216163/XAB) Accelerating private investment in energy conservation: identification and analysis of key barriers and policy tools. Final report.** (Hagler, Bailly and Co., Washington, DC (USA)). Feb 1987. 93p. (HBC/REF—86-181). NTIS, PC A05/MF A01.

A study was undertaken to identify principal barriers to private investment in energy conservation in AID-assisted countries, provide missions and host governments with lists of the barriers, identify issues requiring further research, and recommend future AID efforts to overcome barriers. The research involved reviews of energy-conservation and private-investment literature, discussions with experts, classification of barriers, and compilation of checklists and an associated bibliography. Recommendations arising from the study are aimed at specific industries, agriculture, the transportation sector, building designers, and electric-power interests. Recommendations include price-sensitive signals, financial incentives, elimination of tariff and other import restrictions, tax incentives, standards development, and energy-conservation legislation.

48743 **(PB—88-216361/XAB) Financing energy conservation in developing countries.** (Hagler, Bailly and Co., Washington, DC (USA)). Feb 1987. 84p. NTIS, PC A05/MF A01.

The report discusses traditional and innovative approaches to financing energy conservation and government roles and policy measures to encourage private-sector financing of energy conservation investments. By providing practical information on the various energy-conservation financing options that are available, the report will help private investors in AID-assisted countries identify sources of finance for energy-conservation investments and assist AID missions to design and implement successful private-sector conservation projects and programs.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 48685, 48718, 48818, 48845, 48915

48744 (CONF-8403264—Exc., pp 1.5.1-1.5.9) **Energy supply concept - Northern Oberpfalz (North Eastern Bavaria).** Fenzl, J. 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).
ISW-Manuskriptreihe.

The article reports on the activities of the local administration union 'Regional Development and Energy' and its function as a coordinator between the various special plannings of the authorities concerned in Northern Oberpfalz (Bavaria), a region with ca. 460,000 inhabitants. The goal is to reduce the regions high degree of dependence on mineral oil (70%) in long term and to include the utilization of domestic energy sources (waste heat utilization, biomass, energy saving) and the topics of environment protection in the plannings. The regional energy supply concept was preceded by a model investigation of the Federal Ministry of Regional Planning, Construction Engineering and Urban Planning. Another goal is to coordinate the investment decisions of both the supply firms and the communities and the others involved. (PJH).

48745 (CONF-8403264—Exc., pp 1.6.1-1.6.38) **Energy supply concepts for rural areas: The example of the Nienburg/Weser district.** Goerg, M. 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

The document shows the scope of problems, the goals, the proceeding, the frame data and analysis relating to an energy investigation in the region of Nienburg (Lower Saxony). The saving potentials for households and industry and substitution potentials regarding the regional resources of agricultural and forest residues (straw, wood, biogas, energetically utilizable wastes), hydroenergy, wind and solar energy, waste heat utilization, also in connection with heat pumps are determined and collected. In its final part, the report contains proposals relating to the mobilisation of these potentials in individual concepts, such as projects of energy saving in private and public buildings, industry, initial investigations for an incineration plant, anaerobic fermentation of sewage sludge, utilization of biogas. The use of straw furnaces and solar systems in various fields of application. (PJH).

48746 (CONF-8403264—Exc., pp 1.8.1-1.8.10) **Energy supply concept for the city of Wadern/Saar.** Eberhard, J. 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

For a town with 2,100 inhabitants near Saarbruecken, an energy investigation was carried out. The investigation dealt with setting up a natural gas, district heat and power supply and the use of renenable energy sources from agriculture and forests as an alternative. The starting point in this area with rural structures is a major chemical plant and large loads with connected thermal values of 200-1200 kW each whose demand is met by petroleum. The report mainly refers to the results of a questionnaire presented to households to investigate heating habits, the energy sources used for space heating and to determine the saving potentials in the buildings of the area covered. An essential potential to save energy in space heating is seen in the substitution of unprofitable (over-dimensioned) heating plants by plants corresponding with the norms and with the demand. (PJH).

48747 (CONF-8403264—Exc., pp 1-63) **Urban development and energy supply.** Volwahsen, A. (Prognos A.G., Basel (Switzerland)). 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

Local supply concepts are meant to ensure an improved coordination of the energy supply plans and the urban development plans. At the examples of some authentic cases (Berlin, Rhine-Main Region, Alpirsbach/Black Forest) the present situation of the coefficiency of the deliberations of the parties involved (supply firms, territorial authorities, and consumers) is reported on. The investigations are limited to heat supply because this is the biggest partial energy market: The main working steps in supply planning are found to be: First, the setting up of heat maps, secondly the joint draft (by all involved) of supply variants in form of scenarios and their assessment according to the assessment criteria of being profitable and doing no harm to the environment. (orig./PJH).

48748 (CONF-8403264—Exc., pp 1.12.1-1.12.21) **Thematic extension of heat maps for energy supply concepts.** Heide, R. 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

At the example of the cities of Gelsenkirchen and Bonn (North-Rhine Westphalia), the author shows the planning process and the processing of the information bases for clarifying the small-scale action goals within the framework of the local energy supply concepts. The thematic extension of the existing information basis of the large concept covering a wide area includes cartographic supplements on three levels: To characterize quarters, building-block- and building-block group analyses. Demand sections, households (age of building and sort of heating), residental structures, storable energy sources, large/small loads, heat density, energy saving potential, starting points and restrictions relating to transmission-bound heat supply are determined in each level. (PJH).

48749 (CONF-8403264—Exc., pp 1.13.1-1.13.12) **Conceptualizing and determining objectives of energy supply in regional planning as a help in planning communal site engineering. Example: Regional development plan of the Regierungsbezirk Giessen.** Kraus, M. 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

Regional arrangement plans are made for the social, cultural, economical and ecological development of the region concerned. In the chapter named 'energy' which is reported on here, the goals, plans and measures of energy supply for the time until 1995 are shown for the region of Central Hesse. While in the first Hessian Regional Arrangement Plans the chapter dealing with 'energy' was limited mainly to the plotting of high-voltage, high-pressure gas lines and petroleum pipelines, now the decentralized energy supply with regard to the economical development of the region, the long-term supply guarantee, the national use of energy, the substitution of mineral oil and the reduction of the pollution of the environment are emphasized more and more. The plans are expected to be coordinated with the energy supply firms involved and contain general and special planning advice, statements on goals and principles relating to the energy section. (PJH).

48750 (CONF-8403264—Exc., pp 1.14.1-1.14.5) **Local energy supply concepts and preparatory site engineering planning, the example of Wuppertal.** Zierold, H. (Amt fuer Stadtentwicklung und Stadtforschung, Wuppertal (Germany, F.R.)). 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

The article reports on the communal problems in selecting the appropriate energy supply at the example of the city of Wuppertal (North-Rhine Westphalia) and its specific structural conditions. There is a close coherence between urban development and the planning of the local energy supply concept, the way of gathering information in planning measures for city quarters. Since the traditional way of planning site engineering cannot fulfil the complex claims occurring in planning the local energy supply concept, a high degree of cordination and integration is necessary; and the energy supply system should be regarded as important to the urban development as, for example, the traffic system. (PJH).

48751 (CONF-8403264—Exc., pp 1.15.1-1.15.4) **Meaning of energy-political concepts to the restructuring of cities.** Spreer, F. (Bundesforschungsanstalt fuer Landeskunde und Raumordnung, Bonn (Germany, F.R.)). 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

It was proven in investigations of the Federal Government that an optimal mixture of the various heat supply forms (district heating, gas/electric heating, other forms of heating) according to the structures of the housing estates can bring a 50% saving in primary energy used for heating within the next 20 years. Since in the Federal Republic of Germany more than 40% of the total final energy demand is caused by heating, the energy supply specified according to local conditions can mobilize the largest energy saving potential ever calculated. In addition to energy saving, also domestic and renewable energy sources can be used. This strategy of decentralisation gives the communities and regions a more important energy-political and energy-economical role than they used to have until now. (PJH).

48752 **(DOE/PE—0082) Long range energy projections to 2010.** (USDOE Office of Policy, Planning and Analysis, Washington, DC). Jul 1988. 161p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88015030/JAW.

Significantly higher energy prices, as compared to those in the era of cheap energy that ended in the early 1970's, have stimulated energy production, conservation and the continuing process of innovation and technology improvement. Temporary fuel price declines do not diminish the likelihood that increased market efficiency will enhance our energy goals of adequate energy supplies at reasonable costs in the future. The specifics of future energy prices, production and consumption, however, are quite uncertain and therefore not subject to precise definition. This study attempts to reduce this uncertainty by providing projections of possible world and US energy futures. To aid in this understanding, this study includes a {open←quotes}reference{close←quotes} case and several alternative energy scenario projections based upon different world economic growth, energy efficiency and oil and natural gas resources base assumptions and may also be viewed as a reasonable future, depending upon the perspective of the reader. For instance, the high oil and natural gas resource scenario may be viewed as more likely if ongoing studies indicate a significantly higher US resource base and greater fuel switching potential. 80 figs., 58 tabs.

48753 **(EPRI-P—5711-Vol.1) EPRI fuel forecast review: Volume 1, 1984-1986 research results: Final report.** Oliva, L.; Kennedy, L.; McLeod, P.; Sorenson, K. (Electric Power Research Inst., Palo Alto, CA (USA); Putnam, Hayes and Bartlett, Inc., San Francisco, CA (USA)). Jul 1988. 341p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88014207/JAW.

The Fuel Forecast Review project provides a vehicle for the ongoing review and analysis of fuel market forecasts. The project is designed to produce periodic reports that include an annual overview of current forecasts, together with reviews of forecast updates as they become available, special fuel forecasting topical studies, and more detailed overviews of individual forecast systems from a utility fuel perspective. This volume documents the results of the Fuel Forecast Review (RP2369-20) project from 1984 through 1986. 39 refs.

48754 **(NP—8770304) Determining energy consumption of private households according to energy carriers and intended purposes and the compilation of structure data for the provision with household appliances for the year 1985. Final report.** (ENERWA Beratungsgesellschaft m.b.H. Wirtschaftspruefungsgesellschaft, Koeln (Germany F.R.)). Feb 1987. 42p. (In German). NTIS (US Sales Only), PC A03. Order Number DE88770304/JAW.

The study on the analytical determination of the energy consumption of private households according to energy carriers and intended purpose, ordered by the EEC commissions is presented here. In addition it contains a compilation of structure data on the provision with household appliances and the living conditions for the year 1985. The uses examined here are room heating, warm water use, cooking as well as various electricity uses, such as washing and drying bundry, cooling, light etc. The calculation methods in various areas of use, as well as the results are presented.

48755 **(NP—8770375) Women determine future motorization rate. Shell's forecast of the number of automobiles to the year 2000.** (Deutsche Shell A.G., Hamburg (Germany, F.R.). Abt. Information und Presse). Sep 1987. 32p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770375/JAW.

This is a report on forecasts for the further development of the automobile market to the end of the century, accompanied by illustrative graphs, diagrams, and tables. Given favourable boundary conditions, a continuing high level of newly registered automobiles is deemed possible in the medium term. In the long term the dynamics of motorization remain uncurbed by current estimations. Further topics are the climax of the fourth cycle in the automobile sector (solved initial problems, increase in the total number of automobiles attains that of former peak years, peak of newly registered cars, problems with the demand for replacement), the medium-term growth-rate at a high level (substantial increase in registered cars, scenarios, demand for replacement determines the level of new registrations), and the structural changes of automobile ownership. Evidence is presented that women will determine the further growth of motorization (already every third car is bought by a woman; the structure of car ownership is getting broader). The final chapter is dedicated to the stabilization of motorization (uncertain forecast of the population figure, automobile density, level of automobiles registered at the climax around the turn of the century). (HWJ).

48756 **(NP—8770377) Energy balances 1965-1972.** (Statistisches Landesamt Baden-Wuerttemberg, Stuttgart (Germany, F.R.)). 1987. 62p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88770377/JAW.

Energy balances show the existence and the application of energy sources in a national economy. They are based on numerous official and inofficial statistics. Both the level of knowledge about the illustration of the energy flows in the country in accordance with the problems and the utilizable data available could be improved considerably in the course of the time. For Baden-Wuerttemberg, energy balances have been prepared since 1965. A concept adjusted to the balances of the Federal Government and of the other States has been applied only since 1982. A revision of the energy balances of the years 1973-1981 helped to achieve a series of balances which, from the energy balance of 1973 on, was set up following uniform guidelines. The balances of 1965-1972, however, could be hardly evaluated because of being partly still not published and, in some points, not corresponding with today's level of knowledge. Nevertheless, they do contain a lot of valuable information for observing the long-term developments in the energy supply and should therefore be made accessible to those interested in energy problems; this is the purpose of this publication.

48757 **(PNL-SA—13921) A comparative analysis of errors in long-term econometric forecasts.** Tepel, R. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1986. Contract AC06-76RL01830. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013121/JAW.

The growing body of literature that documents forecast accuracy falls generally into two parts. The first is prescriptive and is carried out by modelers who use simulation analysis as a tool for model improvement. These studies are ex post, that is, they make use of known values for exogenous variables and generate an error measure wholly attributable to the model. The second type of analysis is descriptive and seeks to measure errors, identify patterns among errors and variables and compare forecasts from different sources. Most descriptive studies use an ex ante approach, that is, they evaluate model outputs based on estimated (or forecasted) exogenous variables. In this case, it is the forecasting process, rather than the model, that is under scrutiny. This paper uses an ex ante approach to measure errors in forecast series prepared by Data Resources Incorporated (DRI), Wharton Econometric Forecasting Associates (Wharton), and Chase Econometrics (Chase) and to determine if systematic patterns of errors can be discerned between services, types of variables (by degree of aggregation), length of forecast and time at which the forecast is made. Errors are meas-

ured as the percent difference between actual and forecasted values for the historical period of 1971 to 1983.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 48198, 48290, 48565, 48566, 48686, 48701, 48785, 48786, 48959

48758 (AFLW—87-5) Natural gas crown royalty administration principles resulting from deregulation. Information letter 87-5. (Alberta Dept. of Forestry, Lands and Wildlife, Edmonton (Canada). Public Lands Div.). 2 Feb 1987. 8p. (CE—01609). Alberta Dept. of Energy/Forestry, Lands and Wildlife, Information Centre, Main Floor, Bramalea Bldg., 9920-108 St., Edmonton, Alta., Canada T5K 2M4; $N/C.. Order Number TI88119895/JAW.

As part of the Department of Energy's ongoing review of its royalty regime, the Mineral Revenues Division has conducted an examination of the effect of natural gas deregulation on Crown royalty management policies and procedures. The purpose of this Information Letter is to describe the principles applying to the administration of natural gas Crown royalty beginning with the November 1986 production month. The legislative basis for the content of this letter is the Natural Gas Royalty Regulations (Alberta Regulation 16/74 as amended). These principles are described under the headings of Fair Value, Allocation of Sales to Production Sources, Cost Deductions, Natural Gas Inventory and Storage, and Mainline Straddle Plants.

48759 (DOE/S—0065) Science and Engineering Education. (USDOE, Washington, DC). Jul 1988. 95p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88015362/JAW.

The report is a result of the request by the Secretary of Energy, in February, 1987, for the Energy Research Advisory Board to review the activities of the Department of Energy in science and engineering education to ensure that DOE is playing its proper role to meet both its own project manpower needs as well as to work closely with the other federal agencies and the private sector in the support of scientific and technical education and training. The report concludes that without intervention now to ensure an adequate future manpower supply, the Department is unlikely to achieve its missions in energy and defense R&D. The efforts that DOE has made over the past few years to strengthen its science education programs, especially in the undergraduate and precollege areas, are discussed and opportunities for further strengthening these programs are identified. The report recommends that DOE continue to emphasize its educational mission primarily through support of graduate students and postdoctoral fellows through university grants and contracts which simultaneously serve the research mission of the Department. At the precollege level, the report recommends that DOE target its efforts where it can realize the greatest impact, namely by providing teachers with opportunities for research participation to enhance their science backgrounds and their instructional strategies. The report notes that minorities and women are underrepresented in science and engineering and recommends that DOE support increased participation in science education programs at all levels, precollege through postdoctoral. The report also recommends that DOE maintain a strong continuing education programs at its national laboratories, permit participation by local industries, and encourage private companies involved in energy-related businesses to do more to support science and engineering education.

48760 (MEM—8803) Report to the Minister pursuant to section 39(11) of the Manitoba Hydro Act, March 31, 1988. (Manitoba Ministry of Energy and Mines, Winnipeg (Canada)). 31 Mar 1988. 90p. (CE—01772). Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, Man., Canada R3C 3L6; $5.00 CAN.

Consumers Association of Canada (Manitoba) and The Manitoba Society of Seniors Inc. filed an application with the Manitoba Public Utilities Boards (the Board) on May 29, 1986 pursuant to Section 39(4) of The Manitoba Hydro Act. The price which initiated the application to the Board was a 2.8% rate increase by Manitoba Hydro effective April 1, 1986. Subsequently, rate increases of 9.7% effective April 1, 1987 and 4.5% effective April 1, 1988 were included in the application and were part of the review conducted by the Board. Upon hearing testimony and evidence from the applicants and Manitoba Hydro, the Board believed that the current review process had the following problems: Request for hearing is the responsibility of Hydro's customers, Customer intervention can be random in nature, infrequency of hearings leads to a lack of continuity, increased preparation time, and costs, and the Board made recommendations after the fact, rather than approving rates before they are implemented. The Board believed that the request for a review should not be the responsibility of the consumer. Hydro should be required to apply to this Board for approval of rate changes. The Board concluded that the rate increases were reasonable and also provided fifteen more conclusions and recommendations. 4 figs., 3 tabs.

48761 (ORNL—6434) International considerations associated with economic planning for recovery from a generalized disaster. Jones, D.W.; Hill, L.J. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 138p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88015322/JAW.

This report addresses international economic considerations in planning for recovery from a generalized disaster, including the geographical dispersion of economic activity and the importance of the US dollar in international trade. The discussion includes real trade issues and international monetary considerations or financial considerations, emphasizing the relationship between the two. Included in the discussion of international monetary considerations are the causes, consequences, and resolution of six historical financial crises which are used as analogues for planning for restoration of the international monetary system. Additionally, the foundation of the multinational enterprise and its possible roles in recovery are addressed. Although the report addresses several specific disaster scenarios and appropriate policy responses in reaction to them, a number of important general policy guidelines were discussed. First, international cooperation and coordination are of paramount importance in restoring the effective functioning of the international monetary system. Second, a policy of fixed exchange rates in the aftermath of an international disaster is ill-advised. Third, except for commodities crucial to national defense, domestic import and export controls cannot be justified. Fourth, the extent of real trade reduction during a conflict has widespread financial---as well as real---repercussions. The United States probably could withstand real trade disruptions during a conflict more successfully than many of its current trading partners. Finally, multinational enterprises might be important institutions in recovery from both real and monetary standpoints, acting as the international conduit for capital flows, trade flows, and in more serious disasters, price signals and international monetary and financial reconstruction. 91 refs., 5 tabs.

48762 (ORNL/M—506) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): Environmental Guidance Program Reference Book, Revision 7. (Oak Ridge National Lab., TN (USA)). 29 Feb 1988. Contract AC05-84OR21400. 61p. NTIS, PC A04. Order Number DE88015347/JAW.

This document contains updated information to be included in the CERCLA Manual. Each page in this document replaces a page in the current manual. (TEM)

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 48084, 48085, 48086, 48087, 48132, 48136, 48150, 48150, 48150, 48153, 48154, 48155, 48156, 48157, 48716, 48717, 48784, 48950

48763 (IT—8711, pp 10) The natural gas industry in transition. Keegan, R.J. (Massachusetts Dept. of Public Utilities). 1987. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2F 2P8; $35.00 CAN. (CE—01608; CONF-8711212—).

From 3. annual Canadian natural gas marketing conference; Calgary, Canada (24 Nov 1987).

The author believes that regulatory changes are clearly necessary because price regulation in the gas industry has, over time, failed to meet its principal objectives of promoting economic efficiency and equity among customers. He also states that regulation has failed to achieve these objectives and to provide an appropriate level of stability in the industry because it has been unable to maintain a reasonable balance between the forces of supply and demand. The principal reasons given for this failure are the inflexibility of the regulatory process combined with the existence of substitute products which compete against gas in end-use markets. This paper discusses the changes which have been implemented at the federal level. It also examines the implications of these changes on the natural gas industry, and discusses alternatives available to state regulators for modifying the regulatory approach to local distribution companies given current conditions in the industry.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 48894

2960 Electric Power

REFER ALSO TO CITATION(S) 48365, 48501, 48509, 48718, 48752, 48818, 48928, 48930, 48949

48764 **(CEENB—29061987) The New Brunswick Electric Power Commission annual report, 1986/1987.** (Commission d'Energie Electrique du Nouveau-Brunswick, Fredricton (Canada)). 29 Jun 1987. 37p. (MICROLOG—88-03253). New Brunswick Electric Power Commission, 515 King St., Fredericton, N.B., Canada E3B 4X1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report covers the year's activities of the Commission responsible for generation and distribution of electrical energy in New Brunswick. Data are presented on sales of electric power within the province and for export, the competing energy sources and their importance in the total energy supply, peak demand, and electric energy prices. Interconnections with other power systems are described, new construction and acquisition of new supply sources, such as the purchase of NB Coal Limited in 1986, are outlined. Brief mention is also made of research, conservation and introduction of new technologies. Financial statements are included.

48765 **(DOE/EIA—0226(88/05)) Electric power monthly, May 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 12 Aug 1988. 46p. NTIS, PC A03/MF A01 - GPO; 1; GPO Dep. Order Number DE88015539/JAW.

Total net generation by electric utilities in the United States for the month of May 1988 was 208,144 gigawatthours, only 1 percent higher than the amount reported a year ago. The only energy source reporting a higher level of net generation during May 1988 was nuclear power, 18 percent above what was reported for the same period last year. Hydroelectric net generation and petroleum-fired net generation were each down 12 percent from May 1987. The last monthly increase in hydroelectric net generation compared to the year before was in January 1987. Net generation from both natural gas and coal declined from 1987, but by less than 1 percent. This is the first time since February 1987 that monthly net generation from coal reported a decline when compared to the previous year. During May, nuclear plants produced 19.5 percent of the total US net generation, compared with 16.7 percent during May 1987. During May 1988, Commonwealth Edison Company's Braidwood, Unit No. 2 began operating with a net summer capability rating of 1107 megawatts. Commonwealth Edison Company now owns and operates twelve nuclear units, more than any other electric utility in the United States. Electric utilities in Illinois generate more nuclear power than in any other state. In May, utilities in Illinois generated 4991 gigawatthours from nuclear power, 51 percent above May 1987. Utilities in South Carolina and Pennsylvania followed Illinois' lead by producing 3871 and 3251 gigawatthours, respectively, from nuclear power during May 1988. These three states produced 30 percent of the total electricity generated from nuclear power during May 1988, 38 percent above what was reported during the same period in 1987. 10 refs., 1 fig., 27 tabs.

48766 (EPRI-EM—5732, pp 1.1-1.27) **Marketing as a competitive strategy for electric utilities: An application of the classic principles of warfare.** Faruqui, A. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

Increased competition in the market for electric power services is rapidly changing the natural monopoly status of electric utilities. Weapons are needed by utilities not only to "win" in newly emerging markets but just as importantly to not "lose" in well-established markets. In this paper, a case is presented for using marketing as a strategic weapon to combat the heightened competition. The argument for using marketing as a competitive strategy is presented in an allegorical style, on the basis of analogies with the nine classic principles of warfare. While this has the disadvantage of giving the text a somewhat belligerent tone, it has the considerable advantage of providing a fresh perspective on the subject. 23 refs., 6 figs., 2 tabs.

48767 (EPRI-EM—5732, pp 3.1-3.14) **The industrial energy management.** Hamby, R.E. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

The purpose of this paper is to share some of the experiences of the Tennessee Valley Authority (TVA) related to demand-side management for the industrial sector. The TVA power system serves an area of approximately 80,000 square miles. This area encompasses seven states: almost all of Tennessee, parts of Alabama, Mississippi, Kentucky, Georgia, North Carolina, and Virginia. We now have a power supply of just under 30,000 megawatts. The biggest part of our capacity comes from coal-fired plants, followed by nuclear, hydro, combustion turbines, and pumped storage. 14 figs.

48768 (EPRI-EM—5732, pp 5.1-5.21) **The transition to competition in electric utility industry.** O'Connor, P.R. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

This paper explores historical aspects of the regulatory environment of the electric power industry and reviews the present competitive utility market and current regulatory solutions. The competitive market option is offered as an alternative regulatory strategy which will result in effluent capacity utilization. (DWL)

48769 (EPRI-EM—5732, pp 2.1-2.29) **Industrial marketing: Economic development programs.** Skelton, J.C.; Richmond, C.A. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

Since the 1980s, due to the benefits realized from conservation, reduced economic growth rates, and increased capacity supplies, utilities are in a position to participate actively in the economic development of their service areas. Many utilities are forming new economic development programs or are increasing the scope and size of existing programs. In addition, they are targeting more than industrial growth—industrial retention, high technology, and commercial sector development are also becoming an integral part of their program direction. The objective of this article is programs within the utility industry. The information was collected through a survey answered by 97 utilities. Specifically the survey attempted to: Characterize trends in economic development programs, identify economic development program goals, identify techniques used to measure program results, determine effective methods used to accomplish goals and develop prospects, and determine the effects of regulatory actions on economic development activities. The format of this report reflects the six objectives or topics of the survey. For each topic, results are displayed in graphic formats,

and implications of the results are discussed. Where meaningful, results have been disaggregated by large and small utilities, and by geographic regions. 23 figs.

48770 (EPRI-EM—5732, pp 8.1-8.28) **The use of customer acceptance criteria for demand-side planning.** Fogg, T.T.; Bernstein, H.M.; Lewis, L.E. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

The Rochester Gas and Electric Corporation (RG&E) is a relatively small utility with retail sales in 1984 amounting to 5.6 million MWh. This amount was evenly divided between the residential, commercial, and industrial sectors. Wholesale sales were 1.5 million MWh; these were mostly economy transactions through the New York Power Pool. The system generally peaks in the summer, although the winter peak is not usually far behind. Peak load in the summer of 1984 was 1075 MW and the winter peak that year was 990 MW. Retail revenues in 1984 were $724 million and wholesale sales brought in $60 million. The company serves 273,000 residential customers, 25,000 commercial customers, and 1500 industrial customers. The service territory covers 2689 square miles and includes Rochester, New York's third largest city. Most customers are located near the southern shore of Lake Ontario, although the franchised area extends as far south as the Pennsylvania border. Total population within the territory exceeds 890,000. RG&E recognizes the value of demand-side management (DSM) for better utilization of company resources and for supplying energy needs in the most cost-effective manner possible. 1 ref., 9 figs., 4 tabs.

48771 (EPRI-EM—5732, pp 9.1-9.4) **Reinvigorating utility marketing.** Almquist, E.; Hamlin, C.; Jones, D. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

Spurred by intense competition from both non-traditional and traditional sources, electric utility marketing has entered a new era. It is an era that has evolved from the "gold medallion" days of the 1950s and 1960s, the energy conservation years of the 1970s, and the more recent emergence of the strategic concept of demand-side management. Today's utility environment is dominated by speculation surrounding deregulation and, perhaps more importantly, the reality that customers do indeed have choices. Electric utilities not only face increased competition from natural gas, self-generation, cogeneration, and other electric power companies, but also must confront the economic impact of international competition in manufacturing. To prevail in this challenging environment requires that companies reinvigorate their marketing and planning efforts. Unfortunately, many utilities may find they are less than fully prepared to do so. While a strong customer service orientation, employee loyalty, and a field force with substantial customer contact provide basic marketing strengths, a number of equally important challenges remain in such strategic areas as organizational structure, sales, and planning. Each of these areas is addressed.

48772 (EPRI-EM—5732, pp 10.1-10.24) **Including the customers' perspective in demand side management.** Gellings, C.W.; Flory, J.E. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

Traditionally, marketing was viewed as the process whereby potential customers were encouraged to buy, and current customers were encouraged to buy more. For electric utilities, this rule of thumb translated into the generalized promotion of any new or additional electrical energy use. Later, increasing rates, due to rising production costs, led to lowered energy consumption and that led, spiral fashion, to further increases in rates, decreases in consumption and steadily declining utility earnings. Consequently, electric utilities and their regulators were prompted to re-examine the marketing process. This re-examination has led to a new marketing approach that is carefully planned and strategically targeted. This approach is based on the belief that supply and demand function dynamically, each influencing the other. The new marketing approach has sought to tailor electric products/services to more closely match both customers' needs and utilities' characteristics. A large part of this innovative approach is Demand-Side Management (DSM). DSM is a sophisticated planning/decision framework that assists utility planners in deciding the subject and style of market promotion. 16 refs., 5 figs., 3 tabs.

48773 (EPRI-EM—5732, pp 11.1-11.14) **Demand-side management alternatives.** Khosla, N.K. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

The broad mix of issues confronting utilities today, and uncertainties associated with the near- and mid-term future, have created the need for a new, flexible planning tool, applicable to the utility industry in general and to any given utility in particular. The demand-side management (DSM) concept has been developed specifically to meet this need. Designed for integration with traditional supply-side-oriented planning and operation, it comprises the planning and implementation of activities designed to influence customer application and use of electricity in ways that will produce desired changes in a utility's load shape (i.e., changes in the time pattern and magnitude of a utility's load). Six different load-shape objectives have been identified: peak clipping, valley filling, load shifting, strategic conservation, strategic load growth and flexible load shape. A key element of DSM planning is the determination of DSM technology alternatives available for attaining the specific load shape objective desired. The specific objective of this project was to identify various technology alternatives and develop technical briefs, each containing information on technology description, application, customer and utility impacts and cost/performance data that is necessary to estimate market penetration and load shape impacts. The focus of this project was on the commercial sector. The residential and industrial sectors' alternative descriptions drew significantly on activities previously completed by EPRI. 9 figs.

48774 (EPRI-EM—5732, pp 12.1-12.11) **Making reference load shape utility specific.** McDonald, C. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

This paper describes the overall design and presents some initial results from the Customer Response task of EPRI's DSM project. This task is to develop a data base of end-use load shapes and adjustments that can be used to evaluate the load-shape impacts of DSM options. The primary emphasis of the entire EPRI DSM project is pulling together and packaging results from other EPRI and utility efforts to provide easy-to-use tools and data to support demand-side-management planning efforts. Due to the paucity of end-use load data and available adjustment mechanisms, the customer response task also entails the development of new data and methods. This paper first provides an overview of the overall design of the data base and adjustments that are being developed. Second, the ways that this data base can be used with differing amounts of utility data are illustrated. Third, examples of adjustments for utility-specific characteristics are illustrated. Fourth, an assessment of the efficacy of the statistical proration approach for reconciling end-use shapes with class load shapes is described. This statistical proration method substantially improves the estimates of end-use loads. 4 refs., 9 figs., 2 tabs.

48775 (EPRI-EM—5732, pp 13.1-13.23) **Reference load shapes and response estimates for analyzing alternative rates and marketing programs.** Caves, D.W.; Herriges, J.A.; Windle, R.J. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

Cost-benefit analysis of demand-side-management (DSM) programs requires accurate information on load shapes. The required information falls into two categories—reference load shapes and customer response to DSM. The reference load shape can be defined as the load shape that would prevail in the absence of the DSM program being analyzed. The estimate of customer response is the estimated change in the reference load shape that can be attributed to the DSM program. Although both reference load shapes and customer response are important for cost-benefit analysis, it is important to discuss them separately, since the sources of the two types of information are quite distinct. In this paper we discuss selected topics in the estimation of reference load shapes and customer response. The selection is intended to indicate tools that are becoming available in each of these areas. To limit the discussion to a reasonable number of topics, given the allotted space, we have necessarily had to omit discussion of many relevant tools and methods. 3 refs., 10 figs., 4 tabs.

48776 (EPRI-EM—5732, pp 14.1-14.20) **Integrated value-based planning.** Gellings, C.W. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

Most utility planning methods today still do not start with the customer. They typically start with the utilities' objectives and with assumptions about what the average customer wants. Today's planning methods do not start from the actual needs or concerns of a particular customer (or group of customers). But utilities need such planning methods to effectively do business in this competitive environment. EPRI recognizes the need for such planning methods. Over the last five years it has been developing planning methods that are focusing increasingly on the customer. Such methods have included Demand-Side Management and Least Cost Planning. Now EPRI is developing a new planning approach called "Integrated Value-based Planning". This method truly starts with the customer. It builds upon and integrates the lessons learned from Demand-Side Management, Least Cost Planning and conventional resource planning. This paper explains Integrated Value-based Planning-and identifies some research issues EPRI plans to address. First, the concept of value is defined. Second, some key elements of IVP are described. Third, the relationship of IVP to other utility planning practices, such as Least Cost Planning and Demand-Side Management is reviewed. Finally, some key research issues of IVP are identified. 21 refs., 10 figs.

48777 (EPRI-EM—5732, pp 15.1-15.74) **Analyzing market penetration of end-use technologies and programs (RP2671).** Limage, D. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

Utilities can employ a wide range of market implementation methods to promote the specific technologies or programs that are likely to provide benefits to both the customer and the utility. Examples of such methods include customer education, direct customer contact, trade ally cooperation, advertising and promotion, alternative rate structures, and direct incentives. The selection of the particular method or mix of methods depends on the characteristics of the customer and the utility, the nature of the end-uses, technologies and programs being considered, and a number of other factors including competition. A key issue faced by the utility market planner is therefore the estimation of the potential customer acceptance of a utility program, and the resulting change in market penetration of the end-use technology, device or equipment that will lead to the desired load shape change. A number of different analytical approaches are available to assist the utility planner in estimating market penetration. In the current project to assess customer preference and behavior, a detailed evaluation of methods to analyze and characterize customer decision-making is being conducted. This working paper addresses market penetration models. 18 refs., 2 figs., 4 tabs.

48778 (EPRI-EM—5732, pp 16.1-16.42) **Electricity use in the commercial sector: Insights from EPRI research.** McMenamin, S. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

The purpose of EPRI research in the commercial sector is to improve the market planning capabilities of utilities. To achieve this goal, EPRI has been active in developing and transferring market models, market information, and data gathering methods. These efforts are helping utilities to complete the transition to a market focus. The COMMEND modeling framework provides the conceptual structure for organizing market information. The model defines market segments by type of building, by end use, or both. The model examines three sets of market decisions: Fuel choice (competition), Efficiency choice (technology), and Usage levels (behavior). Regional data bases developed for COMMEND provide a comprehensive picture of commercial sector energy use levels and contribution to electric system loads. The transfer to the industry of the modeling framework and data bases has led naturally to the development of an information network. This network allows industry analysts to share market insights. Utilities have stated that this network has value outside the modeling tools themselves. The purpose of this report is to indicate the types of insights that have emerged from EPRI efforts. A series of EPRI reports provides complete details behind these conclusions. 7 refs., 35 figs.

48779 (EPRI-EM—5732, pp 17.1-17.51) **A review of commercial sector energy use indexes.** McMenamin, S. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

Since the mid-1970s, when commercial end-use models were first developed, industry analysts have used a variety of approaches to estimate energy use index (EUI) values. These values are estimates of average energy use per square foot of floorspace in buildings that have a particular end use. EUIs and fuel shares are the two basic building blocks that provide an estimated breakdown of energy consumption at the end-use level. An increasing amount is known about actual building energy intensities. This body of knowledge reflects the development of a variety of data sets, including the following: the Nonresidential Buildings Energy Consumption Survey (NBECS) conducted by the Energy Information Administration in 1979, and repeated in 1983; a variety of utility surveys, ranging from short mail and phone surveys to detailed on-site surveys; and utility audit program data bases. All of these sources allow the matching of actual energy bills with characteristics of buildings, such as activity type and building size. Average energy intensities for a building type are computed from these data as the ratio of energy use to square footage. The purpose of this report is to develop and present a set of average EUI estimates that utilize the most recent results and that incorporate a wide variety of perspectives. Also, in the process of developing these estimates, several critical issues were considered, and a discussion of these issues is presented here. 14 refs., 13 figs.

48780 (EPRI-EM—5732, pp 18.1-18.25) **Industrial load shaping: An industrial application of demand-side management.** Smith, W.M.; Hu, S.D. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

In recent years competition from various sources such as cogeneration and bypass has led many utilities to refocus attention on their large industrial customers. In particular, utilities are working to strengthen this important market segment by helping large industrial users reduce their electricity costs. In 1984 the industrial sector consumed 842 billion kwh of electricity or about 37% of total US electricity consumption; almost 88% of this usage was associated with manufacturing. Most manufacturing industries make significant use of electricity in their operations, motor drives, accounting for about two-thirds of this demand, is the major application. Electrici-

ty is the primary source of power for pumps, conveyors, fans, and compressors, as well as for the various crushing, grinding, stamping, trimming, mixing, cutting, and milling operations that are widely used in manufacturing. Industry represents an ideal candidate for load shaping because it has fewer facilities than other market segments, each with a relatively high demand for electricity. Because of the large quantity of electricity consumed per facility, industrial load shaping measures are significantly more cost-effective than similar residential or commercial measures. Also, industrial customers are highly cost-conscious because they usually operate on small profit margins. Because they often operate around the clock, they have greater flexibility in schedule modifications—an important advantage in designing the load shaping strategy. 9 figs., 3 tabs.

48781 (EPRI-EM—5732, pp 19.1-19.37) **EPRI industrial demand-side management scoping study (RP2613-9).** Tabors, R.D.; Schweppe, F.C.; Flory, J. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

In an era of increasing competition, electric utilities have expanded efforts to better serve their industrial customers. This scoping study, initiated to determine the potential for future research in the area of industrial demand-side management (DSM), specifically focused on the specialized DSM needs of industrial customers. This study was initiated to determine ways to improve interactions between utilities and their industrial customers. Unlike studies in the past, it focused first on customers' perspectives. In this project, EPRI conducted interviews, via mail and telephone, of both customers and utility DSM planners about their current utility electric service as well as current and future DSM program planning needs, respectively. Once this preliminary information was gathered, two workshops were conducted, one for senior managers of both utilities and industrial customers, and the second for utility middle managers responsible for industrial DSM program planning. Both workshops were held to identify general and specific DSM planning concerns, wants, and needs. Scoping study results indicate that there are several research areas that EPRI could pursue that would help both industrial customers and electric utilities work more effectively together to plan DSM programs that meet the needs of both parties. These research areas are incorporated into a research plan at the conclusion of this report. 7 refs., 3 figs.

48782 (EPRI-EM—5732, pp 20.1-20.36) **Industrial sector demand-side planning data.** Limaye, D.R. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

While the concept of demand-side management is not new, the changing environment of electric utilities has created new challenges related to the planning and design of DSM programs (demand-side planning). The benefits of demand-side options depend on a number of utility and customer characteristics. Important utility characteristics include the existing generation mix, fuel costs, load factor, anticipated load growth, system load shape, and reserve margin. Important customer characteristics include physical characteristics, equipment or appliance inventories, energy use patterns, end uses and end-use load shapes, and attitudes and responses toward utility programs. Because of the diversity of utility and customer characteristics, utilities are planning and implementing a broad range of programs. Previous EPRI studies have provided inventories of such programs. These studies indicate that a majority of the prior utility demand-side management activity has been in the residential and commercial sectors. Now, as utilities are gaining experience from the implementation of residential and commercial programs, they are increasingly interested in planning and implementing DSM programs in the industrial sector. The industrial sector represents a very important customer class for many utilities. Overall, industrial electricity sales represent 36% of the total US electricity sales. Moreover, industrial customers generally have larger loads and higher load factors. This report summarizes the results of a scoping study to identify utility needs for data and analytical tools to support the planning of industrial DSM programs, and to design a project to satisfy some of the most important needs. 9 refs., 16 figs., 4 tabs.

48783 (FRNC-R—238) **Electricity producers and energy conservation in USA.** Lequin, C. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1986. 65p. (In French). NTIS (US Sales Only), PC A04/MF A01; GPO Dep. Order Number DE88754625/JAW.

The aim of this study was to examine the role of the american electric utilities in the development of the alternative energy utilization in the USA. Federal or local financial incentives combined with a growing interest of the private utilities in persuading their users to conserve energy or/and to use alternative energies (together with utility electricity) result in a growing place for alternative energies and energy conservation. Still, since the lowering of the oil prices, a urtain disinterest appeared.

48784 (NP—8770359) **Guided energy pricing impacts on energy conservation. Final report.** Meyer, T.; Garnreiter, F.; Gruber, E.; Jochem, E.; Mannsbart, W.; Poppke, H.; Groener, H. (Fraunhofer-Institut fuer Systemtechnik und Innovationsforschung (ISI), Karlsruhe (Germany, F.R.); Bayreuth Univ. (Germany, F.R.). Lehrstuhl fuer Volkswirtschaftslehre). (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung; Ministerium fuer Wirtschaft, Mittelstand und Technologie des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). Feb 1987. 355p. (In German). NTIS (US Sales Only), PC A16. Order Number DE88770359/JAW.

Contrary to conventional price-by-the-piece sales of goods, electric power, natural gas and district heat sales are characterised by a split structure of prices, i.e. fixed power or basic tariffs and service tariffs varying according to the quantities supplied. The study focuses on the following subjects: Calculation of the negative economic impacts of price splitting on energy conservation using examples representative for the users concerned - comparative evaluation of other countries' guided energy price structures characterized by weaker service or power price components, evaluation of inividual and overall economic aspects - assessment of the experiences gained with load-dependent electric power tariffs and the load management strategies connected with them, centralized multiservice control systems for the Federal Republic of Germany and other countries.

48785 (NEB-SS—NE22-1/1988-3F) **Reasons for decision in the matter of application under the National Energy Board Act of Marine and New Brunswick Electrical Power Company, Limited for exports to the Mine Public Service Company.** (National Energy Board, Ottawa, Ontario (Canada)). May 1988. 14p. (In French). (CE—01733). National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, Ont., Canada K1A 0E5; $N/C.

A licence has been granted to Maine and New Brunswick Electrical Power Company for export of firm power and energy from New Brunswick over a 20-year period to its parent company, Maine Public Service Company of Presque Isle, Maine. Maine Public Service purchases all the electricity generated by its Canadian subsidiary, with the exception of a small quantity used to serve the village of Perth-Andover in New Brunswick. The licence allows the export of up to 37 thousand kilowatts of power and 200 million kilowatthours of energy in any consecutive twelve-month period from July 1988 to June 2008. The licence replaces two existing licences which expire on 30 June 1988. The decision to grant a licence follows a public hearing held before the National Energy Board in Saint John, New Brunswick on 29 March 1988. The Board's findings concluded that the power and energy to be exported are surplus to foreseeable Canadian requirements and that the prices to be changed are just and reasonable in relation to the public interest. 1 fig., 2 tabs.

48786 (NEB-SS—NE22-1/1988-3E) Reasons for decision in the matter of application under the National Energy Board Act of Marine and New Brunswick Electrical Power Company, Limited for exports to the Mine Public Service Company. (National Energy Board, Ottawa, Ontario (Canada)). May 1988. 14p. (CE—01712). National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, Ont., Canada K1A 0E5; $N/C.

A licence has been granted to Maine and New Brunswick Electrical Power Company for export of firm power and energy from New Brunswick over a 20-year period to its parent company, Maine Public Service Company of Presque Isle, Maine. Maine Public Service purchases all the electricity generated by its Canadian subsidiary, with the exception of a small quantity used to serve the village of Perth-Andover in New Brunswick. The licence allows the export of up to 37 thousand kilowatts of power and 200 million kilowatthours of energy in any consecutive twelve-month period from July 1988 to June 2008. The licence replaces two existing licences which expire on 30 June 1988. The decision to grant a licence follows a public hearing held before the National Energy Board in Saint John, New Brunswick on 29 March 1988. The Board's findings concluded that the power and energy to be exported are surplus to foreseeable Canadian requirements and that the prices to be changed are just and reasonable in relation to the public interest. 1 fig., 2 tabs.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 48132, 48765, 48896

48787 (NP—8770364) Project 'Enermetric'. Stage 2 in the development of an information system for continuous monitoring of energy consumption by private households (both volumetric and calorific) as a function of the determinants of energy use, and for reporting on request (tasks of TUeV Rheinland). Vaassen, W.; Engelke, J.; Pofahl, E. (Technischer Ueberwachungs-Verien Rheinland e.V., Koeln (Germany, F.R.). Inst. fuer Energietechnik und Umweltschutz; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1985. 269p. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770364/JAW.

This final report of phase II of the research project 'Enermetric' takes account of the results of phase I. The project was presented to interested users by Infas and TUeV Rheinland already in phase I. The resulting discussions, as well as some political boundary conditions, necessitated some modifications and a shifting of tasks between Infas and TUeV Rheinland. The new tasks of TUeV Rheinland consisted in the development and trial operation of a complete and functional hardware and software system for acquisition and analysis of the energy consumption data of private households. This also included a comprehensive representation of the physical, climatological and constructional influencing parameters, as well as an exemplary evaluation of the measured data in consideration of the measured technical structural data.

48788 (P—8401) Survey regarding energy consumption and conservation practices in retail stores and small industrial businesses. Final report. (Pluram, Inc., Quebec City (Canada)). Jan 1984. 96p. (In French). (CE—01758). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study was based on a sample of 100 businesses in the Montreal metropolitan area which were surveyed on their energy consumption and conservation practices. A literature review was also conducted. The study has permitted the identification of the breadth and complexity of the commercial sector, identified the limits to the creation of a useful survey tool on the methodological level, identified the institutional obstacles particular to this sector as well as promising future areas of research, and has determined the attitudes of the sector on energy conservation and consumption. The heterogeneity of the sector has made the determination of significant overall conclusions difficult. It was noted that energy use is not necessarily connected with the kind of economic activity. Natural gas occupies a most important place in energy use, and it is estimated that the food wholesalers studied use 80% of their energy for refrigeration, while retail stores, offices, and theaters use around 60% of their energy for heating and cooling. 85% of energy used by laundries is used in their process activities. With regard to energy conservation, the measures generally implemented are often those that are simplest, easiest to apply and have the quickest results. The financial aspects of conservation are the most important; the greater the energy bill of a business, the greater the user is preoccupied with conservation. Recommendations are made as to governmental policies that could facilitate energy conservation. 269 refs., 7 tabs.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 48431, 48432, 48480, 48695, 48710, 48711, 48745, 49549

48789 (PB—88-210471/XAB) Current alternative energy research and development in Illinois. Annual report. Swager, R. (Illinois Dept. of Energy and Natural Resources, Springfield (USA)). Dec 1987. 131p. (IL/ENR/AE—86/01). NTIS, PC A07/MF A01.

See also PB—87-166187.

This directory is intended to acquaint researchers, policy makers, and citizens with recent activities in alternative energy research, development and demonstration projects. The topics covered have been limited to those concerned with the development of non-fossil, non-nuclear energy sources. Included are projects in process in October 1987 or that had been completed after December 1986. It attempts to include projects performed by Illinois organizations, both within the state and out-of-state, and projects performed by out-of-state organizations at sites within Illinois.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

REFER ALSO TO CITATION(S) 50257

3003 Thermoelectric Generators

48790 (AD-A—193082/5/XAB) Study on iron disilicide thermoelectric generator. Interim report. Anderson, G. (Tunzini Nessi Entreprise Equipement, Rueil-Malmaison (France)). 30 Nov 1987. 3p. NTIS, PC A02/MF A01.

The first objective of the experimental work is to verify the characteristics of commercially available material. The Japanese company KOMATSU ELECTRONICS LTD sells U-Shaped couples of $FeSi_2$. 24 couples are now in our laboratory. Each leg of the couple is made of one type (N or P) of material and the junction is placed directly into a flame. Being almost impossible to measure the hot junction temperature in the flame and to evaluate the heat flux going through the material between hot and cold junctions, we have designed an experimental assembly was designed, suited to measure these values. The main problem is to obtain a good thermal contact for the hot junctions. If not, there is an important temperature drop between the hot source and the hot junction of the couple leading to wrong values of the characteristics.

3004 Thermionic Converters

REFER ALSO TO CITATION(S) 49339

3005 Fuel Cells

REFER ALSO TO CITATION(S) 48338, 48671

48791 (CONF-850511—Absts., pp 39-42) **Outline of evaluation test of 50 kW-5 ata PAFC power plant.** Takechi, T.; Nakayama, Y.; Sato, M. (Toshba Corp., Tokyo (Japan)). 1985. NTIS, PC A14/MF A01. Order Number DE88008297/JAW.

From Fuel cell seminar; Tucson, AZ, USA (19 May 1985).

This report summarizes the efforts made for the development and evaluation of 50 kW PAFC experimental power plant which was operated to generate rated power successfully last year. The development of fuel cell stack and prototype steam reformer was started in 1980. To verify these technologies in system application, the experimental plant was fabricated at Hamakawasaki Works, of Toshiba connected to its power line. the objectives of this development are to confirm system configuration, process control requirement and plant safety features to accumulate operating experiences and to refine computer model which will be used for system simulation of future plant by verification of those experimental results.

48792 (DOE/MC/23204—2576) **Field testing of DOD fuel cell power plants: Final report.** Ferraro, V.D.; Hegebarth, D.G.; Taylor, R.W. (Science Applications International Corp., San Diego, CA (USA). Advanced Energy Systems Div.). Mar 1988. Contract AC21-86MC23204. 177p. NTIS, PC A09. Order Number DE88001080/JAW.

This report discusses a field test of five 40 kW on-site fuel cell power plants which was sponsored by the US Department of Energy (DOE) in cooperation with the Department of Defense. The field test was conducted at four military bases and DOE's Morgantown Energy Technology Center. The purpose of the field test was to gain experience with the installation, operation, and maintenance of on-site fuel cell power plants to determine their performance characteristics and viability for military applications. A summary of the installation, operation, and maintenance activities and performance results for each power plant is included in the report. A site application/economic analysis is also included for two typical military sites.

48793 (DOE/METC—88/6096) **Fuel cells: A handbook.** Kinoshita, K.; McLarnon, F.R.; Cairns, E.J. (USDOE Morgantown Energy Technology Center, WV). May 1988. Contract AC03-76SF00098. 168p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88010252/JAW.

The purpose of this handbook is to present information describing fuel cells that is helpful to scientists, engineers, and technical managers who are not experienced in this technology, as well as to provide an update on the current technical status of the various types of fuel cells. Following the introduction, contents of this handbook are: fuel cell performance variables; phosphoric acid fuel cell; molten carbonate fuel cell; solid oxide fuel cell; alternative fuel cell technologies; fuel cell systems; and concluding remarks. (AT)

48794 (DOE/PC/79931—3) **Oxygen electrode in molten carbonate fuel cells: Third quarterly technical progress report, February 1-April 30, 1988.** Dave, B.; Adanuvor, P.K.; White, R.E.; Enayetullah, M.A.; Srinivasan, S.; Appleby, A.J. (Texas A and M Univ., College Station (USA)). 1988. Contract FG22-87PC79931. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013720/JAW.

The high temperature equipment necessary for the investigation of oxygen reduction kinetics using microelectrodes was set up. Three types of microelectrodes were designed and fabricated. Experiments are underway to examine the microelectrodes in respect to (1) their stability in the molten carbonate environment; (2) oxygen reduction kinetics and mass transport parameters in aqueous electrolytes for comparison with similar results using other techniques; and (3) oxygen reduction kinetics and mass transport parameters in molten carbonate electrolytes. The reaction sequences for oxygen reduction in melts of various carbonate mixtures were simulated on the basis of a postulated kinetic model involving the reduction of O{sub 2}{sup 2{minus}} and O{sub 2{minus}} ions at the electrode. Auto-catalytic reactions involving the reaction of O{sub 2}{sup 2{minus}} and O{sub 2{minus}} species with O{sub 2} and the neutralization reaction of O {sup 2{minus}} ions by CO{sub 2} in the melt were taken into account. Enhancement of oxygen reduction currents occurs at high rates of oxygen dissolution in the melt. Changes in the auto-catalytic reaction rates of O{sub 2}{sup 2{minus}} and O{sub 2{minus}} affect the polarization curves significantly only in the presence of dissolved oxygen in the melt. 8 figs.

48795 (EPRI-AP—5789) **Development of molten carbonate fuel cell components: Final report.** Paetsch, L.; Pigeaud, A.; Chamberlin, R.; Maru, H. (Electric Power Research Inst., Palo Alto, CA (USA); Energy Research Corp., Danbury, CT (USA)). Jul 1988. 184p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88014201/JAW.

This final report summarizes the results of molten carbonate fuel cell (MCFC) component development carried out under EPRI Research Project RP1085-3. The effort under this project was focused on matrix development, design of cell edge seal and separator plate, and electrolyte management. The MCFC is a high efficiency electrochemical power generator, operating at 650{degree}C, and utilizing alkali carbonates as the electrolyte. The subject areas identified above are among the key issues which must be addressed before components can be scaled up and tested in multicell stacks. Under the project, an electrophoretic deposition technique was developed for cost-effective fabrication of matrices. Cell edge seal designs were studied and appropriate corrosion protection approaches were developed. Two different types of bipolar separator plates were investigated and tested in short stacks. Various electrolyte loss mechanisms including vaporization, creepage, corrosion and potential-driven migration were investigated, modeled and quantified. Approaches for minimizing these losses were identified and tested in a cell for 10,000 hours. Post-test electrolyte inventory analyses on this cell indicated that it was feasible to design a cell package to provide endurance of at least 3 years without requiring any external replenishment arrangements. 4 refs., 42 figs., 19 tabs.

48796 (PNL—6077) **Assessment of methanol electro-oxidation for direct methanol-air fuel cells.** Fritts, S.D.; Sen, R.K. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014686/JAW.

The Office of Energy Storage and Distribution of the US Department of Energy (DOE) supports the development of a methanol-air fuel cell for transportation application. The approach used at Los Alamos National Laboratory converts the methanol fuel to a hydrogen-rich gas in a reformer, then operates the fuel cell on hydrogen and air. The reformer tends to be bulky (raising vehicle packaging problems), has a long startup period, and is not well suited for the transient operation required in a vehicle. Methanol, however, can be oxidized electrochemically in the fuel cell. If this process can be conducted efficiently, a direct methanol-air fuel cell can be used, which does not require a reformer. The objective of this study is to assess the potential of developing a suitable catalyst for the direct electrochemical oxidation of methanol. The primary conclusion of this study is that no acceptable catalysts exist can efficiently oxidize methanol electrochemically and have the desired cost and lifetime for vehicle applications. However, recent progress in understanding the mechanism of methanol oxidation indicates that a predictive base can be developed to search for methanol oxidation catalysts and can be used to methodically develop improved catalysts. Such an approach is strongly recommended. The study also recommends that until further progress in developing high-performance catalysts is achieved, research in cell design and testing is not warranted. 43 refs., 12 figs., 1 tab.

48797 Numerical simulations of the reditron. Kwan, T.J.T.; Davis, H.A. (Los Alamos National Lab., Los Alamos, NM (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* 16: No. 2, 185-191(Apr 1988).

The reflected electron discrimination tube (reditron) is a high-power, narrow-band, and single-mode microwave generator which makes exclusive use of the oscillatory character of the virtual cathode of a relativistic electron beam. In a basic virtual-cathode configuration, there are two competing mechanisms generating microwaves, namely, the oscillating virtual cathode and the reflexing electrons between the real and virtual cathodes. Furthermore, they tend to interfere destructively with each other. Specifically, the reflexing electrons can cause considerable heating of the electron beam via two-stream instability and fluctuations of the diode impedance resulting in oscillations of the electron beam energy. The authors demonstrated theoretically a concept which was subsequently proven experimentally to effectively remove these undesirable effects. In addition, they found that high-power, narrow-band, and monochromatic microwaves could be generated with efficiency of 10 to 20 percent by the reditron. They also found that further optimization could be achieved by the use of a density (current) modulated electron beam at appropriate frequencies.

48798 Methods to advance technology of proton exchange membrane fuel cells. Ticiannelli, E.A.; Derouin, C.R.; Redondo, A.; Srinivasan, S. (Los Alamos National Lab., Los Alamos, NM (US)). pp 166-181 of Electrode materials and processes for energy conversion and storage. Srinivasan, S.; Wagner, S.; Wroblowa, H. Pennington, NJ; The Electrochemical Society (1987). (CONF-8705216—).

From 2. symposium on electrode materials and processes for energy conversion and storage; Philadelphia, PA, USA (11 May 1987).

Proton exchange membrane fuel cells (generally referred to as solid polymer electrolyte fuel cells), were developed by the General Electric Company. Although these fuel cells show promise of a high level of performance, this was attained, until the present time, using electrodes that contain a high platinum loading (4 mg/cm/sup 2/). It was recently demonstrated in our laboratory that, by the incorporation of Nafion into porous gas diffusion electrodes containing only one-tenth of the platinum, the same level of performance could be attained as with electrodes containing the high noble metal loading. This paper presents improvements in performance of proton exchange membrane fuel cells by (1) extension of the three dimensional reaction zone, which is achieved by incorporating a proton conduction (Nafion) into the electrode structure; (2) optimization of the amount of Nafion impregnated into the electrode structure; (3) hot-pressing the impregnated electrodes to the Nafion membrane at 120°C and at 50 atm; (4) optimal humidification of reactant gases at a temperature above the cell temperature (5° for O/sub 2/ or air and 10-15°C for H/sub 2/); and (5) operation at elevated temperatures and pressures. The performance of the cell was analyzed from measurements of cell potential vs current density and from measurements of cell potential at constant current density vs time. Cyclic voltammetry proved to be a useful tool to ascertain the electrochemically active areas of the electrodes.

48799 Fuel cells for extraterrestrial and terrestrial applications. Srinivasan, S. (Los Alamos National Lab., Mechanical and Electronic Engineering Div., MSD429, Los Alamos, NM (US)). pp 108-128 of Electrode materials and processes for energy conversion and storage. Srinivasan, S.; Wagner, S.; Wroblowa, H. Pennington, NJ; The Electrochemical Society (1987). (CONF-8705216—).

From 2. symposium on electrode materials and processes for energy conversion and storage; Philadelphia, PA, USA (11 May 1987).

The fuel cell is a nineteenth-century invention and a twentieth-century technology development. Hydrogen-oxygen fuel cell systems have no competition as auxiliary power sources for space vehicles. The alkaline fuel cell system is a proven technology for this application. The solid polymer electrolyte system may be its future competitor. The energy crisis of 1973 stimulated research, development, and demonstration of the phosphoric acid, molten carbonate, solid oxide and solid polymer electrolyte fuel cell systems using natural gas, petroleum or coal-derived hydrogen (and carbon monoxide for the high-temperature systems) for terrestrial applications. The direct methanol-air fuel cell is still an electrochemist's dream. The present price of crude oil, and the high capital costs and limited life time of fuel cell systems impede their terrestrial applications in the developed countries. Conversely, the potential for lower capital costs of labor-intensive manufacturing processes and the relatively higher fossil fuel prices make these systems more attractive for such applications in the developing countries.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 48682, 48741, 48783

3201 Buildings

REFER ALSO TO CITATION(S) 48362, 48363, 48372, 48666, 48667, 48687, 48694, 48713, 48723, 48723, 48754, 48779, 48788, 48927, 48933, 49346, 49623, 49765

48800 (AD-A—192684/9/XAB) Reduction of energy consumption for air conditioning while maintaining acceptable human comfort. Student report. Meister, D.J. (Air Command and Staff Coll., Maxwell AFB, AL (USA)). Apr 1988. 49p. (ACSC—88-1810). NTIS, PC A03/MF A01.

This project demonstrates that energy consumption for air conditioning can be reduced while still maintaining acceptable comfort for building occupants. The primary purpose of air conditioning is to provide a comfortable environment. However, in an era where energy cost and availability are key concerns, the goal is to provide maximum comfort at minimum cost. Information is provided on the key factors that affect comfort and a method to quantify the level of discomfort. Results of computer simulations show that the 78° thermostat setpoint used for air conditioning is too conservative and wastes energy. Energy consumption can be reduced by as much as 20%, depending on the climate of the location, while maintaining an acceptable thermal environment.

48801 (AFME—83-0216-17) Optimal control of energy systems. Delcambre, B.; Martin, J. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). Feb 1984. 80p. (In French). NTIS (US Sales Only), PC A05/MF A01; GPO Dep. Order Number DE88754614/JAW.

The stochastic optimal control problem for a dwelling zone with electric heating floors and convectors is studied in order to minimize, on a 24 hours basis, the energy total costs with certain thermal conditions and comfort being maintained. The heating floors are modelized and the mathematical model is integrated in a bulding thermal state model for the simulation of the system operation under optimal control.

48802 (BEG—8412) GRAPHEAT: Graphical Passive Housing the Annual Analysis Technique. A design aid for estimating the annual space-heating energy consumption and thermal comfort in energy-efficient/passive-solar residential buildings. (Building Engineering Group, Waterloo, Ontario (Canada)). Dec 1984. 79p. (CE—01749). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This manual presents a simple graphical method for quickly estimating the annual space-heating energy consumption and assessing the thermal comfort in low-energy passive solar residential buildings in Canada. It is primarily intended for use at the conceptual stage of design. The method comprises four steps: the calculation of the above-grade heat loss coefficient, the calculation of the maximum indoor temperature swing due to solar heat gain, the calculation of the below-grade heat loss, and the calulation of the annual space heating energy consumption. A worksheet and nomogram are used in each step. A worked example is presented. Climatic data for 23 Canadian cities are provided. 29 refs., 30 figs.

48803 (BFH/S—041981) Comparative evaluation of commercial building energy analysis computer programs. Jones, L. (BFH/Shawinigan, Ottawa, Ontario (Canada)). Apr 1981. 87p. (CE—01693). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report reviews the suitability of currently available energy analysis programs for evaluating retrofits to building & HVAC systems. The report starts with an overview of eighteen energy analysis programs currently available in Canada from which four programs are selected for further analysis. Each of these four programs is reviewed in detail in accordance with the terms of reference for the study. This entails documenting and commenting upon the way the various programs attempt to model such things as solar gains, infiltration and heat storage. Finally, an evaluation is made of the four selected programs on the basis of how well they are perceived to model various features considered desirable and/or necessary for retrofit analysis. 5 refs., 4 figs., 3 tabs.

48804 (BNL—52148) Proccedings of the 1987 oil heat technology conference and workshop. Coughlan, R.T. (ed.); McDonald, R.J. (ed.). (Brookhaven National Lab., Upton, NY (USA)). Jan 1988. Contract AC02-76CH00016. 239p. (CONF-870681—). NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88012509/JAW.

From Oil heat technology conference; Upton, NY, USA (22 Jun 1987).

This report documents the proceedings of the 1987 Oil Heat Technology Conference and Workshop, conducted on June 22 and 23 at Brookhaven National Laboratory (BNL) under sponsorship by the US Department of Energy - Office of Buildings and Community Systems (DOE-OBCS). The meeting was held in cooperation with the Petroleum Marketers Association of America. The 1987 Oil Heat Technology Conference, which has been the third held since 1984, is a key technology transfer activity supported by the ongoing Combustion Equipment Technology program at BNL, and is aimed toward providing a forum for the exchange of information and perspectives among international researchers, engineers, manufacturers and marketers of oil-fired space-conditioning equipment. The objectives of the Conference are to: Identify and evaluate the current state-of-the-art and recommend new initiatives for satisfying consumer needs cost-effectively, reliably and safely; Foster cooperative interactions among federal and industrial representatives in accordance with the common goal of national security via energy conservation. The 1987 Oil Technology Conference comprised: Two plenary sessions devoted to presentations and summations by public and private sector representatives from the United States, Europe and Canada; and Five workshop sessions which focused on mainstream issues in the field of oil-heating technology.

48805 (CA—8408) Design guidelines, window architectonics. MacGowan, D.; Eaton, M.; Harris, A. (Manitoba Univ., Winnipeg (Canada)). Aug 1984. 87p. (CE—01743). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This technical report documents studies which have taken place over a three-year period between the Universities of Manitoba and Washington. The research focussed on three strategies for window design, namely, window size and shape in relation to view, wall proportion, climate and culture; discomfort glare; energy; and making these strategies useable by the design professions. In the first stage, window size studies have shown that the solid angle subtended by the window at the location of the observer can be a more appropriate means of expressing minimum window size. The second stage is concerned with investigating an energy optimization discomfort glare formula which has been implemented in stages three and four of this report. In the third stage of the collaborative study, window size and window luminance criteria are merged with energy issues. The approach places considerable emphasis on the design and location of work stations, while respecting classical approaches to the design of form in relation to function. Study results are reported in summary form in this document. 89 refs., 36 figs., 20 tabs.

48806 (CMHC—8301) Passive solar and internal heat gain analysis used in CMHC-2. Tremayne, M.A. (Canada Mortgage and Housing Corp., Ottawa, Ontario). Jan 1983. 13p. (CE—01775). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report identified alternative techniques used to analyze passive solar gain through windows. The suitability of the alternative methods was favourably reviewed, with particular reference to the requirements of the monthly analysis used in the CMHC-2 program. This document also describes the accounting process that is used to determine usable heat gains in CMHC-2. 7 refs., 4 figs.

48807 (CMHC—8301) Modelling the microclimate in CMHC-2. Tremayne, M.A. (Canada Mortgage and Housing Corp., Ottawa, Ontario). Jan 1983. 17p. (CE—01776). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Weather patterns differ from one location to another due to man-made and natural geographic effects. With proper accounting of these effects, a more realistic modelling of the energy anlaysis of a house may be achieved by the CMHC-2 computer program. This report presents a quantification of the effects that man-made and natural geographic items have on long term recorded solar radiation, wind speed and air temperature data. Interim adjustment factors for the long term climatic (air temperature, solar radiation and wind velocity) published values which are used in CMHC-2 are developed. 5 refs., 8 tabs.

48808 (CMHC—8301) Significance of wind and radiation effects upon the conductive heating requirements of a house. Tremayne, M.A. (Canada Mortgage and Housing Corp., Ottawa, Ontario). Jan 1983. 82p. (CE—01777). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study reports on the effects of wind and radiation upon the conductive heat loss through the exterior wall and roof-ceiling surfaces of a house. Radiant energy exchange affects the surface temperature of an exterior surface. Thus, both of these effects modify the heat loss characteristics of an exterior surface such as an exterior wall or roof. A mathematical analysis technique was created and implemented into the CMHC-2 program to model the radiation energy transfer for roofs and walls. The significance of wind and radiation effects was ascertained by comparing the conductive heat loss through an exterior wall and ceiling under various wind speed and solar radiation conditions. Radiation transfer upon a roof can decrease the conductive heat loss of a roof by 5%. This transfer mechanism should be accounted for by increasing the effective thermal resistance of the roof-ceiling assembly by 5%. Radiation transfer upon an exterior wall is very significant and can change the annual conductive heat loss of a wall by as much as 10 GJ (.066 GJ/m/sup 2/). Wind speed, solar radiation, wall R-value, shading, and exterior finish are all important parameters in quantifying this value. 7 refs., 8 figs., 46 tabs.

48809 (CMHC—8301) Definition of Canadian weather sites for CMHC-2. Tremayne, M.A. (Canada Mortgage and Housing Corp., Ottawa, Ontario). Jan 1983. 10p. (CE—01778). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The purpose of this report is to identify the minimum number of cities required to form a regionally sensitive weather data base, for the entire Canadian climate, for use in the CMHC-2 energy analysis computer program. An evaluation of the major climatic factors affecting space heating requirements and heating system size in housing was made for geographic and population centres in Canada. Its purpose was to determine unique locations needed to permit CMHC-2 to have application for the entire country. It resulted in the defining of 61 primary sites for which detailed climatic data is needed. A further 140 secondary sites have been related to the primary sites for heating energy analysis purposes as the program is capable of modeling in over 200 Canadian locations.

Further evaluations using the analysis features within the program are recommended to verify the choice of 61 sites. 1 fig., 2 tabs.

48810 **(CMHC—8301) Thermal interrelationships used in CMHC-2.** Parsons, L.J. (Canada Mortgage and Housing Corp., Ottawa, Ontario). Jan 1983. 92p. (CE—01779). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The CMHC-2 program was developed to analyze heating energy requirements and to cost effectively rank potential structure improvements in houses. This computer based information system was developed to support CMHC's mandate of providing affordable housing for Canadians. Many computer programs exist which attempt to model the heating energy requirements of buildings. These are available for mainframe, mini and microcomputers. Large programs facilitate the use of complex heat transfer algorithms which are therefore able to produce a very precise thermal model, but are expensive and time consuming to use. The heat transfer algorithms, or thermal interrelationships used in a program attempt to model the actual dynamic energy transfers taking place. The thermal interrelationships used in CMHC-2 were chosen for being concise, in view of the fact that the program is being made available to microcomputer users (wherein program storage space is relatively limited). The thermal interrelationships used in the program are documented. The report includes sections for overall dwelling heat loss factor, building (free) heat gains, annual heating energy requirements and required heating system capacity, based on design conditions. 10 refs., 8 figs., 12 tabs.

48811 **(CMHC—8301) Verification of accuracy of wind and radiation calculations in CMHC-2.** Tremayne, M.A. (Canada Mortgage and Housing Corp., Ottawa, Ontario). Jan 1983. 9p. (CE—01780). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report reviewed portions of the CMHC-2 computer program dealing with effects of wind and radiation upon the flow of heat through the exterior walls and roof of a house. The objective of this report was to substantiate that the CMHC-2 program is performing the calculations properly and accurately. Several heat transfer mechanisms occur upon a wall or roof exposed to the outdoors. These are conduction and convection between the surface and surrounding air, absorption of solar radiation during the daytime, and emission and absorption of radiation between the surface, and the sky and surroundings, both day and night. Determination of the accuracy of the CMHC-2 calculations was made by comparing the heat loss through an exterior wall and roof, as calculated by the CMHC-2 computer and a manual analysis. Calculations were made for a rural and urban site using Ottawa weather data for the months of April and December. Comparison of the values generated by the two methods showed the computer calculated values were identical to those calculated by the manual analysis. 6 refs., 3 tabs.

48812 **(CMHC—8301) Heat transfers in a house due to the domestic water system.** Tremayne, M.A. (Canada Mortgage and Housing Corp., Ottawa, Ontario). Jan 1983. 26p. (CE—01782). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report reviewed the magnitude of the internal heat gains and losses from the domestic water system of a house. It was prepared to develop a proper accounting of these transfers for use within the Canada Mortgage and Housing Corporation computer program. This heat transfer to the house is a result of the heat gain from the Domestic Hot Water (DHW) system, and the heat loss to the Domestic Cold Water (DCW) system. For various ranges of water use, heat transfers from the DHW and DCW systems were found. The heat transfer varies proportionally to the temperature difference between the respective water system and indoor temperature. Since the average Canadian electrical energy consumption for DHW was 14.1 kWh/day, the ratio of net heat gain to average electrical consumption for DHW was 1/7. This study concluded that for the CMHC-2 program, a need exists to evaluate the thermal performance of different water heaters, and the inlet water temperature (ground temperature) for various months.

48813 **(CMHC—8301) Typical electrical consumptions by domestic water heaters and appliances for use in CMHC-2.** Tremayne, M.A. (Canada Mortgage and Housing Corp., Ottawa, Ontario). Jan 1983. 36p. (CE—01783). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report summarized the results of a Canada-wide survey to obtain residential electricity consumption for appliances, lights and miscellaneous uses as well as the domestic hot water heater. The surveys were obtained from provincial utilities by telephone conversation. The Ontario Hydro and Hydro-Quebec information was derived from published reports. The surveys were undertaken to identify average electrical energy consumption which is a required input of the CMHC-2 program. By accurately quantifying this consumption, a more realistic analysis of space heating, domestic water heating, and total energy requirements can be made by the program. The average Canadian electrical energy consumption, for domestic hot water, and for lights plus appliances is 14.1 and 17.0 kWh/day (or 5,146 and 6,205 kWh/year) respectively. The annual electrical energy consumption, for appliances (in Manitoba), follows a monthly sinusoidal variation with an amplitude of 144 kWh. It is recommended that a similar annual variation in appliance electrical energy consumption be implemented within the CMHC-2 program. This would facilitate the modelling of appliance electrical energy consumption for any site. 2 refs., 6 figs., 9 tabs.

48814 **(CMHC—091982) Comparison between CMHC-2 and DBR-NRC [Department of Building Research, National Research Council] basement heat loss analysis techniques.** Tremayne, M.A. (Canada Mortgage and Housing Corp., Ottawa, Ontario). Sep 1982. 32p. (CE—01721). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The CMHC-2 and the unpublished National Research Council of Canada Division of Building Research (DBR) techniques of analyzing basement heat loss were compared via computer simulation. This study was undertaken to determine the accuracy of the CMHC-2 method, relative to the DBR method. Several basement installation systems were simulated using the CMHC-2 and DBR analysis techniques. The predicted basement heat losses, as calculated by each technique, were then compared. The simulations in the CMHC-2 program reveal that the water table depth has a significant effect on the loss from basement walls and floors. The DBR method neglects this vital variable. Both methods show very reasonable agreement in the calculation of basement heat loss, predicting within several GJ of one another, when the water table depth in the CMHC-2 method is about 3 meters below the basement floor. Since the DBR method does not consider a variable water table depth, which has been shown to be a significant factor in basement heat loss, it will not be used within the CMHC-2 program. The method presently implemented within the CMHC-2 program produces realistic levels of basement heat loss for a number of soil and water table depth considerations. It is recommended that the present CMHC-2 analysis for basement heat loss remain unaltered within the program. 3 refs., 6 figs., 11 tabs.

48815 **(CONF-871203—4) Modeling of thermal resistance test configurations that use thin heaters.** Yarbrough, D.W.; McElroy, D.L.; Graves, R.S. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014567/JAW.

From Conference on insulation materials, testing and applications; Bal Harbour, FL, USA (6 Dec 1987).

The usefulness of a large unguarded thin screen heater as an integral part of a thermal resistance measurement apparatus for insulations has been demonstrated. Thermal modeling of existing and proposed test configurations can be used to establish applicability. HEATING5, a general purpose conduction program, has been used to obtain the temperature distributions encountered in linear and radial heat flow testers with thin heaters. Thermal simulations of

the existing screen tester have been used to determine the effects of specimen thickness and thermal resistance on measurement errors. Simulation results were obtained for test configurations in order to provide a basis for design improvement, i.e., the effect of increasing levels of edge insulations on the apparent thermal conductivities obtained with the tester. The extent to which limited edge guarding extends the operating range of a flat tester has been examined using HEATING5. A gradient guard along the edge of the specimen in the tester reduces the measurement errors due to edge heat loss. The improvement predicted by HEATING5 in measurement accuracy of a thin heater apparatus due to edge guarding that approximately matches the mean temperature on the edges with the mean temperature in the metering section has been examined experimentally. 10 refs., 10 figs., 3 tabs.

48816 **(CONF-871203—5) The thermal resistance of fine powders at atmospheric pressure and under vacuum.** McElroy, D.L.; Weaver, F.J.; Yarbrough, D.W.; Graves, R.S. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014556/JAW.

From Conference on insulation materials, testing and applications; Bal Harbour, FL, USA (6 Dec 1987).

Heat transport measurements are reported on candidate insulation systems with relatively high thermal resistances for use in appliances. The thermal resistances of small diameter silica powders at atmospheric pressure and under vacuum were measured from 295 to 340 K using unguarded radial heat flow techniques. The thermal resistances of rectangular panels containing perlite or silica powder at reduced pressure were determined using an unguarded linear heat flow technique. Values of 1.2m²{center←dot}K/W for 0.0254 m (R-7 per inch) were obtained at atmospheric pressure for powders of pure, fumed, amorphous 0.01 μm dia silica particles compacted to about 10% of theoretical density. Values of 0.7 m²{center←dot}K/W for 0.0254 m (R-4 per inch) were obtained at atmospheric pressure for powders of impure, amorphous (0.3 μm dia) silica particles. Under vacuum these particle systems yielded thermal resistances as high as 6 m²{center←dot}K/W for 0.0254 m (R-34 per inch), and mixtures with the pure silica particles yielded over 9 m²{center dot}K/W for 0.0254 m (R- 50 per inch). Evacuated panels of pure silica particles yielded thermal resistance values over 3 m²{center←dot}K/W for 0.0254 m (R-17 per inch) and decreased about 5% in resistance in 39 months. Evacuated panels of a perlite powder yielded similar values. 18 refs, 8 figs, 2 tabs.

48817 **(CONF-880627—4) Measurement of field thermal performance parameters of building envelope components.** Courville, G.E.; Beck, J.V. (Oak Ridge National Lab., TN (USA); Michigan State Univ., East Lansing (USA). Dept. of Mechanical Engineering). 1988. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013832/JAW.

From ASHRAE annual meeting; Ottawa, Canada (25 Jun 1988).

A new technique for analyzing field-derived thermal performance data is described; it is incorporated in a computer program called PROPOR. This technique utilizes modern computational methods and relies on recent advances in data acquisition that make possible the accumulation of accurate data from field implanted sensors. In this paper the ability to use statistical analysis in assessing the reliability of PROPOR is discussed. The data base is temperature and heat flow information collected for expanded polystyrene (EPS) insulation in a built-up roof specimen over an eight month period. The specimen was mounted in the Roof Thermal Research Apparatus at Oak Ridge National Laboratory. In particular, it is shown that incorporating successively more sophisticated models for the thermal conductivity of expanded polystyrene into PROPOR decreases the RMS errors between measured and calculated internal temperatures, decreases the 95 percent confidence interval for the results, and randomizes the distribution of residuals, defined as the differences between measured and calculated temperatures and heat fluxes during the course of the test period. By using a temperature-dependent model for thermal conductivity having three linear segments, it is shown that the same conductivity curve is obtained for all seasons. 13 refs., 7 figs., 3 tabs.

48818 **(CONF-880701—3) Analysis of water heater data from Athens load control experiment.** Reed, J.H.; Thompson, J.C.; Broadwater, R.P.; Chandrasekaran, A. (Oak Ridge National Lab., TN (USA); Tennessee Technological Univ., Cookeville (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02. Order Number DE88014558/JAW.

From IEEE Power Engineering Society summer meeting; Portland, OR, USA (24 Jul 1988).

This paper describes water heater load control experiments on the Athens Utilities Board distribution system in Athens, Tennessee. Data from experimental days are compared to data from days of normal operation to assess the effects of the control experiments. Plots are presented to describe water heater operation. Water heater models are used to estimate water usage. Results indicate that water heater control reduces energy demand but may have adverse effects on daily load patterns. Analysis also shows that the operation of load control receivers deteriorates as the time duration of the control period is increased. Methods used to improve data integrity are presented. The results are based on the filtered data set. The problems of identifying the associated time skew in the data and the timing-out of load control receivers are addressed. These results should be of interest to utilities performing similar load control management. 10 refs., 10 figs., 3 tabs.

48819 **(CONF-880814—2) The effect of house indoor temperature on measured and predicted energy savings.** Ternes, M.P.; Stovall, T.K. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014563/JAW.

From Summer study on energy efficiency in buildings; Pacific Grove, CA, USA (28 Aug 1988).

In many major residential weatherization studies, the average measured energy savings have been less than the predicted savings. Additionally, large scatter in the measured energy savings has been observed. Changes in the indoor temperatures of the houses before and after weatherization have often been cited as a possible explanation for these results. This paper draws upon results from two studies conducted by the Oak Ridge National Laboratory in an attempt to determine if the variation and lower than expected performance in energy savings are attributable to house indoor temperature levels. 9 refs., 2 figs., 4 tabs.

48820 **(CONF-880814—6) Infiltration testing of homes constructed to the BPA Model Conservation Standards Program.** Kolb, J.O. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013201/JAW.

From Summer study on energy efficiency in buildings; Pacific Grove, CA, USA (28 Aug 1988).

The Bonneville Model Conservation Standards (MCS) require air sealing techniques to reduce incidental infiltration in homes below levels found using conventional construction techniques. Measurements of infiltration in 35 MCS code-instructed homes are reported in this paper using two techniques: blower door depressurization and short-term tracer gas decay to measure incidental infiltration and total infiltration with an air-to-air heat exchanger operating. The MCS homes were located in four Early Adopter jurisdictions of the MCS program{endash}two in Washington and two in Idaho. The Idaho jurisdiction had significantly greater success meeting the "tight" infiltration control standard level results are discussed relative to the construction and air sealing practices with air-to-air heat exchangers operating were found to vary above and below the MCS code specified rates in a significant number of homes tested. 4 refs., 2 figs., 6 tabs.

48821 (CONF-8403264—Exc., pp 1.4.1-1.4.18) **Planning buildings and housing estates according to climate conditions.** Weidlich, B. (Weidlich Ingenieurgesellschaft, Berlin (Germany, F.R.)). 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

The article contains in its first part determinants of the energy need of a building which are of importance from the view-

point of regional planning; the second part contains energy-relevant planning principles of regional planning; it closes with the third part which contains 12 rules of site engineering planning taking into account climate conditions. These 12 rules were taken from the research report 'Rational Use of Energy in Planning Site Engineering' which was set up by order of the Federal Ministry of Regional Planning, Construction Engineering and Urban Planning. (orig./PJH).

48822 (CONF-8804100—7) Development and proof-testing of advanced absorption refrigeration cycle concepts, Phase 2. Reimann, R.C.; Melikian, G. (Oak Ridge National Lab., TN (USA); Carrier Corp., Syracuse, NY (USA); United Technologies Research Center, East Hartford, CT (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02. Order Number DE88013239/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

This paper summarizes the results of the work performed to date under Phase II of the DOE program. The Phase II objective is to design, fabricate, and proof-test a natural gas-fired absorption heat pump (AHP) with an efficiency level substantially higher than present day state-of-the-art equipment. To achieve these objectives, Carrier investigated the performance of the candidate Phase I fluids (lithium bromide:zinc bromide/methyl alcohol-MEOH or lithium bromide:water methylmine-MMA) as well as high concentration formulations of the conventional LiBr/H2O mixture for high temperature, upper loop use. These results were compared with several existing fluid candidates including ammonia/water. 9 figs.

48823 (CONF-8804100—10) Worldwide survey of absorption fluids data. Macriss, R.A.; Zawacki, T.S. (Institute of Gas Technology, Chicago, IL (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02. Order Number DE88013204/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

The overall objective of this study is to develop improved data for the thermodynamic, transport and physical properties of absorption fluids. A specific objective of this phase of the study is to compile, catalog and coarse-screen the available worldwide data of known absorption fluid systems and publish it as a reference document to be distributed to manufacturers, researchers and others active in absorption heat pump activities. 3 refs., 3 figs., 1 tab.

48824 (CONF-8804100—11) Entrainment enhancement of a supersonic jet for advanced ejectors. Jou, Wen-Huei; Knoke, G.S.; Ho, Chih-Ming. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02. Order Number DE88013200/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

Improved ejector performance is required for heat-actuated heat pump applications. Laboratory experiments were conducted to investigate the use of a new rectangular supersonic nozzle configuration for mixing enhancement. Noncircular nozzles were previously found to increase substantially the jet entrainment in subsonic flow. Both flow visualization using schlieren photographs and pitot measurements in the far field indicate that the improvement in mixing for a supersonic jet is as good as that for a subsonic jet if not better. Mixing enhancement using a rectangular jet provides a technology basis for the development of the desired ejectors for heat pump applications. 9 refs., 8 figs.

48825 (CONF-8804100—12) CFC [chlorofluorocarbon] restrictions: Energy impacts and technological alternatives. Creswick, F.A.; Fischer, S.K. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013196/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

Recent international negotiations have resulted in an agreement to restrict the production and use of fully halogenated chlorofluorocarbons. ORNL has conducted a study of technological alternatives to the use of restricted chlorofluorocarbons in building applications and associated potential energy-use impacts. R-123 and R-134a have been identified as promising substitutes for R-11 and R- 12. If these substitutes prove to be fully acceptable, energy-use impacts will be nominal. An urgent near-term need exists for information on the engineering properties of these fluids. If the use of substitutes does not prove to be acceptable, the energy-use impact would be an increase of about 1.0 quad per year if R-22 is available as a substitute and about 2.7 quads per year it not. The latter scenario is regarded as a serious consequence. The major impacts result from reduction in the R value of insulation for domestic refrigerator-freezers and in residential and commercial building insulation. In the long term, alternative technologies are available that could nullify any of the adverse energy-use impacts of chlorofluorcarbons restrictions.

48826 (CONF-8804100—15) Capacity modulation component characterization and design tool development. Rice, C.K. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03. Order Number DE88013842/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

This effort has been focused on obtaining and evaluating modulating component and drive performance data for electric-driven, air-to-air residential heat pumps. The modulation means considered here are continuously variable-speed drives. The modulating performance data were obtained for purposes of: Establishing a technology base for modulating components; providing a foundation for modulating model development; and screening compressor and drive types to be used in modulating system design assessments. For the screening analyses, the relative performance of various compressors and drives was evaluated under appropriate modulating conditions. With the modulating components sufficiently characterized and the modulating models developed, the potential of advanced modulating heat pump systems for residential application can be assessed accurately. 21 refs., 6 figs., 1 tab.

48827 (CONF-8804100—16) Development of an advanced cycle absorption heat pump for residential applications. Phillips, B.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013841/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

This paper is a second report on a program funded by the Department of Energy which has the purpose of developing residential thermally activated heat pumps based on an advanced absorption cycle. The first report referred to Phase I and the start of Phase II of the program. The present report covers Phase II and the part of Phase III now under way. The overall objectives of the program are to develop a gas-fired absorption residential heat pump with air to air operation and having coefficients of performance greater than 0.7 in cooling mode and 1.6 in heating mode at the ARI rating conditions. 2 refs., 8 figs.

48828 (CONF-8804100—17) Laboratory capacity modulation experiments, analyses and validation. Miller, W.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 15p. NTIS, PC A03. Order Number DE88012930/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

A combined experimental and analytical project was conducted on a breadboarded continuously variable speed air-to-air heat pump (CVSHP). The split-system residential unit of nominal 2-3/4-ton (9. 7-kW) cooling capacity was instrumented and tested in environmental chambers. The steady-state, frosting/demand defrosting, and cycling efficiency characteristics of the CVSHP with first generation components (e.g., heat exchangers, compressor, and

indoor blower, both having variable speed induction motors) were measured in the laboratory for compressor drive frequencies ranging from 15 through 90 Hz. Steady-state efficiency data were used to validate an initial version of the Oak Ridge National Laboratory steady-state modulating heat pump design program. Algorithms were developed from reduced dynamic loss data from which calculations were made of the seasonal losses for the test CVSHP. 18 refs., 10 figs., 5 tabs.

48829 (CONF-8804100—18) Overview of ground coupled heat pump research and technology transfer activities. Baxter, V.D.; Mei, V.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012938/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

Highlights of DOE-sponsored ground coupled heat pump (GCHP) research at Oak Ridge National Laboratory (ORNL) are presented. ORNL, in cooperation with Niagara Mohawk Power Company, Climate Master, Inc., and Brookhaven National Laboratory developed and demonstrated an advanced GCHP design concept with shorter ground coils that can reduce installed costs for northern climates. In these areas it can also enhance the competitiveness of GCHP systems versus air-source heat pumps by lowering their payback from 6-7 years to 3-5 years. Ground coil heat exchanger models (based primarily on first principles) have been developed and used by others to generate less conservative ground coil sizing methods. An aggressive technology transfer initiative was undertaken to publicize results of this research and make it available to the industry. Included in this effort were an international workshop, trade press releases and articles, and participation in a live teleconference on GCHP technology. 21 refs., 4 figs., 4 tabs.

48830 (CONF-8804100—20) DOE absorption program overview. DeVault, R.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02. Order Number DE88013827/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

Advanced technologies for gas-fired absorption heat pumps for building space conditioning (heating and/or air conditioning) are being developed with the US Department of Energy support. Single- effect cycle absorption heat pumps for residential application were demonstrated in the 1970s but proved to be uneconomic and were not manufactured. Advanced technology absorption heat pumps with substantially higher efficiencies are now being developed and have the potential to be economically competitive with existing HVAC equipment while saving energy. 11 refs., 3 figs.

48831 (CONF-8809103—1) Modeling of residential attics with radiant barriers. Wilkes, K.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02. Order Number DE88012496/JAW.

From 5. annual symposium on improving building energy efficiency in hot and humid climates; Houston, TX, USA (13 Sep 1988).

This paper gives a summary of the efforts at ORNL in modeling residential attics with radiant barriers. Analytical models based on a system of macroscopic heat balances have been developed. Separate models have been developed for horizontal radiant barriers laid on top of the insulation, and for radiant barriers attached to the bottom of the top chords of the attic trusses. The models include features such as a radiation interchange analysis within the attic space, convective coupling with the ventilation air, and sorption/desorption of moisture at surfaces facing the attic enclosure. The paper gives details of the models and the engineering assumptions that were made in their development. The paper also reports on the status of efforts that are underway to verify the models by comparing their predictions with the results of laboratory and field tests on residential attics and test cells, both with and without radiant barriers. Comparisons are given for a number of selected sets of experimental data. Suggestions are given for needed model refinements and additional experimental data. Plans for utilization of the models for extrapolation to seasonal and annual performance in a variety of climatic conditions are also described. 32 refs., 3 figs., 4 tabs.

48832 (CONF-8809103—2) Effect of surface mass on roof thermal performance. Wilkes, K.E.; Shipp, P.H.; Sanders, J.P. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03. Order Number DE88013245/JAW.

From 5. annual symposium on improving building energy efficiency in hot and humid climates; Houston, TX, USA (13 Sep 1988).

The roof of a building is exposed to the most severe environment that is expected by any component of a building envelope. Diurnal peak surface temperature of 140 to 185{degree}F are not uncommon. The addition of thermal mass to the exterior surface of the roof should lessen the severity of the environment that is experienced by the roof membrane and the roof insulation. The exterior mass should result in attenuation both of temperature extremes and of heat flux variations. It also may result in lowered net heat flow through the roof. This paper presents some results of a combined experimental and analytical study to quantify the effects of surface mass. Measurements were made on roof test panels that were exposed to the weather of eastern Tennessee. The test panels consisted of glass fiber insulation with a modified bitumen membrane. Experiments were conducted on a bare panel and on panels that were loaded with either concrete pavers or aggregates. A heat transfer model for the bare panel and the panel with concrete pavers was developed to calculate the internal temperatures and heat fluxes using measured indoor and ambient conditions. The model was validated by comparing its predictions with measured values. Following validation, the model was used to perform a parametric study of the effects of various levels of surface mass. 5 refs., 8 figs., 3 tabs.

48833 (CONF-8809103—3) Power signatures as characteristics of commercial buildings. MacDonald, J.M. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02. Order Number DE88013205/JAW.

From 5. annual symposium on improving building energy efficiency in hot and humid climates; Houston, TX, USA (13 Sep 1988).

This paper proposes the use of "power signatures" as an important concept for building energy analysis. Power signatures are considered to contain "energy or power characteristics" of a building. Developing relationships between energy characteristics and building physical characteristics is seen as an important area for improvement of analytical tools for commercial and related buildings. Knowledge of the causes of variations in energy use, and the expected relative impacts of different schedules, functional uses, and energy systems, should be improved. A categorization of analysis methods is presented to define the parameters of interest for several currently used methods. Power signatures indicate building energy behavior with respect to time, so the parameters of interest are average power level and time of occurrence. Because a rate quantity (power) is used, comparisons between different time steps are practical. If practitioners could begin using power signature concepts to present energy use data on buildings, improved communication of results appears possible. Potential future study could be continued in several areas to improve the use of power signatures and energy analysis overall. 30 refs., 6 figs.

48834 (CRIQ—5-1596) Cooling of a building by means of stored natural ice. (Centre de Recherche Industrielle du Quebec, Sainte-Foy (Canada)). Feb 1983. Vp. (In French). (CE—01774). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study describes a program to develop a novel method of producing cold water used in cooling systems using storage of ice formed naturally during the winter. A study was made of ice formation and melting, applicable to Quebec conditions, and of the methods and systems for storing the ice and using the ice for cooling a building during the summer. A pilot project was undertaken to construct a well-insulated storage building of about 17x17x16 ft used to store an ice block of 8x8x10 ft formed in successive layers

by an automatic system using cold exterior air. Experience obtained during one winter was used to determine the optimal layer thickness, frequency of formation as a function of exterior air temperature, and the amount of air required for freezing. During the subsequent hot season, the ice block was used to cool part of the basement of a nearby building. Energy transfer measurements were made to determine the effectiveness of the thermal exchange systems used. An economic analysis was made to compare the cost of this cooling method with more conventional systems. Technical results were positive, and economic evaluation indicated that realizing this project on a larger scale would not involve costs higher than those necessary for a conventional mechanical cooling system. The operating, maintenance, monitoring and energy costs are minimal; this is an attractive option for Canadian climatic conditions. 6 refs., 55 figs., 13 tabs.

48835 (CT—ENFORP228) Feasibility study on the conversion of an oil/gas heating plant at C.F.B. Borden to a biomass fuel plant. (Turner (C.G.) and Associates Ltd., Toronto, Ontario (Canada)). Sep 1982. 47p. (CE—01701). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

To determine the feasibility of converting oil/gas fired energy plants at C.F.B. Borden to wood fired energy production and assess the quantity of wood available from mill and logging residue, stand conversion, tree salvage, timber arrangement and energy plantation were the objectives of this report. The supply and costs associated with transportation and delivery have also been investigated. The investigation also covers the feasibility of converting the existing boilers from gas to wood firing, capital cost, manpower and operating costs. To undertake the study, one medium sized energy plant has been designated by C.F.B. Borden as a representative model and the investigation was focused on the feasibility of converting the plant to wood produced energy. It was found that the economics of burning wood waste are not favourable in comparison to gas firing. The increased capital cost and labour costs are not offset by the lower fuel cost. 17 refs., 3 figs., 12 tabs.

48836 (DOE/CE/30753—T1) Electrochromic materials for controlled radiant energy transfer in buildings: Final technical summary of research, 2 August 1982--31 October 1985. Goldner, R.B. (Tufts Univ., Medford, MA (USA). Dept. of Electrical Engineering). 1986. Contract AC03-82CE30753. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014666/JAW.

Electrically controlled variable reflectivity electrochromic windows have the potential to significantly reduce heating, cooling, and lighting loads in buildings. The theoretical and experimental research at Tufs during this contract has led to improved modeling and understanding of the properties of thin polycrystalline films of WO_3 the presently leading candidate for the electrochromic layer of solid-state smart window structure. The research has shown that $LiAlF_4$ is a good ion-conducting and electron-insulating material which may be suitable for use as the ion conductor layer in a lithium based electrochrómic structure. The research has identified the materials indium oxide (In_2O_3) and tin-doped indium oxide as potential ion-insertion material and thus candidates for the counterelectrode (EC) layer as well as the transparent conductor layer of these devices. The research to date demonstrated that it is highly likely that an all-soild-state-thin-film electrochromic smart window can be developed, in the near future. Further important fundamental research needs to be done before a full-fledged development effort is initiated. 17 refs.

48837 (DOE/ER—0375) The initial atmospheric behavior of radon decay products. Hopke, P.K. (Illinois Univ., Urbana (USA). Inst. of Environmental Studies). Jul 1988. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013965/JAW.

The chemical and physical properties of ^{218}Po immediately following its formation from ^{222}Rn decay are important in determining its behavior in indoor atmospheres and play a major part in determining its potential health effects. In 88% of the decays, a singly charged, positive ion of ^{218}Po is obtained at the end of its recoil path. The modes of neutralization, small-ion recombination, electron transfer, and electron scavenging are reviewed. In typical indoor air, the ion will be rapidly neutralized by transfer of electrons from lower ionization potential gases such as NO_2. The neutral molecule can then become incorporated in ultrafine particles formed by the radiolytic processes in the recoil path. Evidence for the formation of these particles is presented. 52 refs., 16 figs., 1 tab.

48838 (DOE/ER/60669—1) The development and field testing of a system for determination of ultrafine activity particle size distribution and working levels: Technical progress report, April 1, 1988-August 31, 1988. Hopke, P.K. (Illinois Univ., Urbana (USA)). 1988. Contract FG02-88ER60669. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014985/JAW.

Recent investigations of radon decay products in indoor air have shown that what has been called the {open←quotes}unattached{close←quotes} fraction is in fact an ultrafine size aerosol with diameters in the range of 0.5 to 10 nm. There are a number of difficulties in characterizing particles in this size range. Classical diffusion batteries using screens with high mesh numbers do not have the resolution to give detailed information for the ultrafine range. The use of single screens of differing* mesh numbers (Graded Screen Arrays) either in parallel or in a stacked configuration can be used to provide these results. However, accurately measuring the activity directly attached to the screens is difficult because of the attachment of some activity to the back side of the screen and the distribution of activity around the individual screen wires. A continuous monitoring system that would provide information on both the size and charge distributions on these important size range particles is being constructed for subsequent field testing. In addition, calculational studies have been made to optimize the selection of flow and screen parameters to permit the most complete and accurate reconstruction of the activity size distribution from a limited number of measurements. The results of these studies are presented in this report. 38 refs., 2 figs.

48839 (DOE/SF/16305—1) Whole-building moisture experiments and data analysis: Task 1 final report. Cummings, J.B.; Kamel, A.A. (Florida Solar Energy Center, Cape Canaveral (USA)). 5 Feb 1988. Contract FC03-86SF16305. 102p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88013287/JAW.

For four months (August--November) in 1987 whole-building moisture capacitance experiments were done on a townhouse in Cocoa, Florida. The experiments were designed to: observe the response of a building to imposed moisture flux; determine the moisture storage capacity of the building and furnishings; evaluate simple models designed to predict the response of room air humidity ratio to pulses of moisture; and assess two innovative approaches of cooling (off-peak cooling and DESRAD). The results of the tests indicate that moisture storage in the furnishings is much greater than moisture storage in the air. The bare building has a total moisture storage capacity of eight times as much as could be stored by the air mass alone. When 345 kg of grade 59 silica gel was added to the building, the storage capacity increased to 20 times that of the building air mass. A simple model predicting room humidity ratio response is proposed. It is called the effective air mass moisture capacity (E/sub m/) model. This model has two forms, the 1-room or 2-room model. Comparisons with measured data show that the 1-room model underestimates the amplitude and phase lag of the room humidity. The 2-room E/sub m/ model provides a much improved match of the amplitude and time lag of the room humidity. 4 refs., 41 figs., 4 tabs.

48840 (EPRI-EM—5884) The indoor environment of commercial buildings: Final report. Grimsrud, D.T.; Brown, J.T.; Fisk, W.J.; Girman, J.R. (Electric Power Research Inst., Palo Alto, CA (USA); Lawrence Berkeley Lab., CA (USA)). Jul 1988. Contract AC03-76SF00098. 132p. NTIS, PC A07/MF A01 - Research Reports Center, Box 50490. Palo Alto, CA 94303; 1; GPO Dep. Order Number DE88014905/JAW.

This report reviews current information that has been gathered recently about the indoor environment in commercial build-

ings. Basic background information about air pollutants, their concentrations and control presented. Special attention is given to a discussion of ventilation systems since these systems provide the basic pollutant control function for the building. The contribution of pollutants, malfunctioning ventilation and other causes to building complaints is a recurring theme of the treatment. 173 refs., 10 tabs.

48841 **(FRNC-TH—3298) Propagation of a periodical thermal signal through a composite wall.** Cantet, M. (Toulouse-3 Univ., 31 (France)). Jun 1977. 60p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754630/JAW.

A mathematical model for the prevision of the temperature distribution in and around a composite wall made of several materials placed side by side is presented. The temperature distribution is obtained for any boundary conditions; especially, for periodical boundary conditions, the transient and steady states are calculated. The analytical results are compared with experimental measures in a wall made of concrete and plaster.

48842 **(IC—82-150) Erickson arena wood-burning furnace.** (Victor and Burrell (Canada)). Mar 1985. 25p. (CE—01807). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objective of this paper is to demonstrate and verify the viability and energy cost savings possible in using a renewable natural resource (wood) in rural areas as an alternative energy source. The project was completed in March, 1985. The analysis showed that the wood-burning furnace is adequate to supply all the heat required in the heated area of about 15m x 30m x 5.5 high, except on exremely cold days. In an average year, the savings in electricity should be approximately $2,700, based on 3.886 cents/kWh. The main disadvantage of a wood-burning furnace is its labour intensive operation. This project has demonstrated that wood-burning furnaces are viable, especially in rural areas where, a plentiful supply of wood is available at little or no cost, manpower is available, at no cost, to operate and maintain the furnace and that the building is at a remote location where the cost of electricity or oil is high.

48843 **(LA—11250-M) Passive solar design procedures for naval installations.** Wray, W.O.; Peck, C.E. (Los Alamos National Lab., NM (USA)). May 1988. Contract W-7405-ENG-36. 184p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88015052/JAW.

This handbook presents methods for applying passive solar heating concepts to the design and construction of buildings in the continental United States. Included are discussions of daylighting, direct gain, radiant panels, thermosiphoning air panels, thermal storage walls, Trombe walls, concrete block walls, water walls, and sunspaces. Figures and tables present data for use in applying these concepts, and worksheets guide the handbook user through the step-by- step procedures. A detailed example demonstrates the application of these solar design concepts in the design of an appropriate system at a specific location. 28 figs., 8 tabs.

48844 **(LBL—23793) Cost effective lighting.** Morse, O.; Verderber, R. (Lawrence Berkeley Lab., CA (USA)). Jul 1987. Contract AC03-76SF00098. 10p. (CONF-8707184—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014661/JAW.

From NATO advanced study institute conference on demand-side management and electricity end-use efficiency; Povoa Do Varzim, Portugal (20 Jul 1987).

Long-life replacement lamps for the incandescent lamp have been evaluated with regard to their cost effectiveness. The replacements include the use of energy buttons that extend lamp life as well as an adaptive fluorescent circline lamp that will fit into existing incandescent lamp sockets. The initial, operating, and replacement costs for one million lumen-hours are determined for each lamp system. We find the most important lighting cost component is the operating cost. Using lamps that are less efficient or devices that cause lamps to operate less efficiently are not cost-effective. The adaptive fluorescent circline lamp, even at an initial cost of $15.00, is the most cost effective source of illumination compared to the incandescent lamp and lamp systems examined. 3 refs., 6 tabs.

48845 **(LBL—24213) Energy Analysis Program, FY 1987: Applied Science Division Annual report.** Cairns, E.J.; Levine, M. (Lawrence Berkeley Lab., CA (USA)). Mar 1988. Contract AC03-76SF00098. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88014056/JAW.

This FY 1987 Annual Report, by the Applied Science Division of the Lawrence Berkeley Laboratory, overviews their Energy Analysis Program. The report covers five major topic areas which include Building Energy Analysis, Building Energy Data, Energy Conservation Policy, International Energy Studies, and Resource Market Mechanisms.

48846 **(LBL—24214) Applied Science Division annual report: Building Energy Systems Program, FY 1987.** Cairns, E.J.; Wahlig, M.A. (Lawrence Berkeley Lab., CA (USA)). Mar 1988. Contract AC03-76SF00098. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014055/JAW.

The main theme of the Program is the comprehensive simulation, analysis, monitoring, and evaluation of the energy performance of whole buildings, with the emphasis on nonresidential buildings. Many of the projects involve developing and applying the types of comprehensive computer models that enable integrated analyses of heating, cooling, and daylighting system performance. A further activity involves research on absorption heat pumps for solar cooling and gas-driven applications, and analysis of the performance and economics of solar cooling systems. 36 refs., 6 figs., 2 tabs.

48847 **(LBL—25035) An analysis of the differences between monitored indoor temperatures and reported thermostat settings.** Vine, E.; Barnes, B.K. (Lawrence Berkeley Lab., CA (USA)). Mar 1988. Contract AC03-76SF00098. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014050/JAW.

We examined differences in reported winter thermostat settings and monitored temperatures, and contrasted those households with little difference, and those with a substantial difference. This analysis was conducted on households participating in Bonneville Power Administration's Residential Standards Demonstration Program (RSDP) in the Pacific Northwest. The reported thermostat settings were obtained from a survey of RSDP participants, and indoor temperatures were read from special recorders inside the house. 9 refs., 5 figs., 4 tabs.

48848 **(LBL—25148) Window 3.1: A computer tool for analyzing window thermal performance.** Reilly, S.; Arasteh, D. (Lawrence Berkeley Lab., CA (USA)). May 1988. Contract AC03-76SF00098. 7p. (CONF-880615—5). NTIS, PC A02. Order Number DE88013708/JAW.

From Solar '88: American Solar Energy Society annual meeting and 13th national passive solar conference; Cambridge, MA, USA (18 Jun 1988).

WINDOW 3.1 is a public-domain computer program developed by the Windows and Daylighting Group at Lawrence Berkeley Laboratory for analyzing heat transfer through window systems. The program uses an iterative technique to calculate the one-dimensional temperature profile across a user-defined window system. From this data, window system performance indices (e.g., U-value, shading coefficient) are calculated. WINDOW 3.1, a major update to WINDOW 2.0, incorporates several technical additions and many new user-friendly features, and provides a consistent and versatile means for heat transfer analysis as did WINDOW 2.0. WINDOW 3.1 can vary environmental conditions, window tilt, number of glazing layers, layer properties (thermal infrared, solar and visible optical properties, and thermal conductance), gap widths, composition of gap gas fill, and spacer and frame materials. This paper presents an overview of the computational methodology, describes the capabilities of the program, and discusses the applications of WINDOW 3.1 for standardizing window heat transfer calculations and in designing new insulating window systems. 7 refs., 5 figs.

48849 **(LBL—25437) The experience of energy conservation programs with new commercial buildings.** Vine, E.; Harris, J. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 18p. (CONF-880814—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013710/JAW.

From Summer study on energy efficiency in buildings; Pacific Grove, CA, USA (28 Aug 1988).

As part of Lawrence Berkeley Laboratory's Least-Cost Utility Planning Project, we have recently completed a review and assessment of the experience of 30 energy conservation programs with new commercial buildings in the US and other countries. The focus was on non-mandatory strategies, which complement, reinforce, or in some cases may substitute for energy-efficiency requirements in building codes. The programs are primarily conducted by state and federal agencies and utility companies. The types of programs investigated include: large-scale demonstrations, financial incentives, energy rating and labeling, energy awards, design tools, design assistance, and standards-related training, compliance and quality control programs. We focus our discussion on design assistance programs and examine available data on market penetration, energy and cost savings, program costs, and cost-effectiveness. Despite the scarcity of quantitative evaluation data on most programs, we present our major findings and make recommendations for program managers interested in designing and implementing energy conservation programs for new commercial buildings. 13 refs., 4 tabs.

48850 **(MHA—8408) Chemical hazards and energy conservation in buildings.** Holliday, M.G.; Fletcher, D.; Park, J.M. (Holliday (M.) and Associates, Ottawa, Ontario (Canada)). Aug 1984. 137p. (CE—01750). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The report is a review of available information relevant to chemical hazards and energy conservation in buildings. It outlines measures for conserving energy in both dwellings and commercial buildings, identifies the most common sources of indoor air pollution together with the pollutant levels expected, discusses the potential health effects of these pollutants, and considers possible connections between conservation measures and health effects. It is concluded that, of all the areas which may be considered, the quality of indoor air is the one which is most likely to have a bearing on public health. While it is acknowledged that energy conservation measures per se are neither obvious nor proven sources of adverse health effects, the injudicious application of such measures (e.g., use of unvented space heaters, excessive air sealing) could be regarded as a problem. The following goals are recommended: establishment of air-quality standards, setting specifications for maximum pollutant emission rates for building materials, estimation of the chemically hypersusceptible population, and improved public education into aspects of indoor air pollution. 170 refs., 6 figs., 30 tabs.

48851 **(NP—8770307) Effects of heating system design on installation costs, service life, control characteristics, and availability.** Brocher, E. (Institut fuer Bauforschung e.V., Hannover (Germany, F.R.)). Nov 1986. 154p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770307/JAW.

Improved thermal insulation of buildings and the creation and utilization of novel heating technologies are of special importance among all the possibilities of saving energy. Particularly the combination of these two methods seems to promise great success for the future with a low, reasonable expenditure for the operation of heating systems. Within the framework of the research report, we are shown the individual heating-technical measures to be taken and how they impact the costs of installing and operating heating systems. The investigation is restricted to heating systems with a nominal heat output of 4-50 kW, taking into consideration the transporting agent water. Water heating is left out of account. In detail, following topics are dealt with: 1) The technique of heat supply with its various components; 2) Installation and operation of the systems; 3) the costs relating to installation and operation techniques of the systems. At the end, conclusions are made basing on these points. The investigation includes following heating systems: Single-room heating, multi-room heating, flat heating, building heating, heating in a block of houses, district heating.

48852 **(NP—8770311) Building construction in accordance with climatic conditions and energy conservation. An introductory manual.** Luetkemeyer, I.; Schreck, H. (Technische Univ. Berlin (Germany, F.R.). Fachbereich 21 - Umwelttechnik). 1987. 44p. (In German). NTIS (US Sales Only), PC A03. Order Number DE88770311/JAW.

Ecological building construction is a synthesis of different fields and branches aiming at the minimization of energy demands and materials the erection and upkeep of buildings involve, the optimum utilization of natural systems and renewable energy sources, the minimization of the quantities and concentrations of air pollution, water pollution, waste heat, municipal wastes, and sealed surfaces. In addition, ecological building construction intends to preserve or even increase the flora and fauna and provide for an adequate integration of buildings into the landscape. An illustrated survey dealing with above problems points out the fundamentals of building construction in accordance with climates and energy conservation, design criteria (e.g. minimization of energy demands, maximization of natural energy gains, optimization of heating systems), and several passive solar heating systems, i.e. windows facing south (direct gains), solar air heaters (indirect gains), heat storage walls (indirect gains), and attached greenhouses (combined gains). (HWJ).

48853 **(NRC/BR—34) Improvement of airtightness in four schools. Building practice note, 34.** Shaw, C.Y. (National Research Council of Canada, Ottawa, Ontario. Div. of Building Research). Jun 1982. 6p. (CE—01661). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Air leakage tests were conducted on four Ontario schools, before and after they were retrofitted, in order to determine the effectiveness of various measures for reducing leakage. The air leakage characteristics of the four schools were determined using fan pressurization. The schools were tested both with the air handling system in operation and with the system shut down, to permit comparison of leakage characteristics before and after retrofit, for both conditions. It was found that caulking wall joints will generally reduce air leakage and is worthwhile if the joints are accessible. Replacing leaky windows will also improve airtightness but may not be cost effective. Routine inspection of outside dampers of the air handling system can help ensure continued airtightness of schools. 1 ref., 6 figs.

48854 **(NRC/BR—179) Direct digital control of small- and medium-size buildings. Building research note, 179.** Elmahdy, A.H.; Beattie, D.G. (National Research Council of Canada, Ottawa, Ontario. Div. of Building Research). Dec 1981. 8p. (CE—01716). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The control of heating, ventilating and air-conditioning (HVAC) systems is changing as a result of applying direct digital control (DDC) techniques to HVAC control. This report outlines the main features of DDC compared with conventional pneumatic control. Four main advantages of DDC are: control can be as simple or sophisticated as desired, and can be changed easily; the system is more reliable because fewer electromechanical components are needed; control is more accurate because of the inherent greater accuracy of DDC electronic components; and energy is saved because an overall strategy eliminates energy waste resulting from simultaneous heating and cooling, which usually occurs in pneumatic systems. An ancillary benefit is the ability of the DDC system to include facilities other than HVAC. Direct digital control is now cost competitive with pneumatic control for HVAC controls in small- to medium-size buildings. Given the other advantages of DDC, particularly its ability to accommodate changes to control strategy and to provide detailed reports of building performance, DDC should become the dominant technology for buildings in this

size range. For small- to medium-size buildings, this report shows that the DDC system can pay for itself within 2 years, after which it effects net savings over pneumatic systems. 2 refs., 4 figs.

48855 **(NRC/BR—180) Recorded energy consumption in school buildings.** Elmahdy, A.H. (National Research Council of Canada, Ottawa, Ontario. Div. of Building Research). Jan 1982. 41p. (CE—01717). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

As part of an attempt to define appropriate energy consumption targets for different classes of buildings in Canada, this report contains data on the annual energy consumption in school buildings. The data presented in this report have been extracted from information provided by various schools and boards of education. A summary is presented of the maximum, minimum and average floor areas and annual energy consumption in MJ/m/sup 2//y for each sample of schools, together with other information on the type of school involved, the sample size and the year in which the data were recorded. A complete listing of energy consumption data for various schools and school boards is also given. When more than one year of data for a particular group of schools was available, a plot was added to show all changes in energy consumption greater than or equal to 0.3 GJ/m/sup 2//y. The information indicates that energy consumption varies considerably within a specific location. This is due to many factors, such as the activity level in each school, the type of construction, the heating and cooling system used and the existence of energy conservation programs. For example, the Protestant School Board in Montreal has been actively involved in an energy conservation program for its school buildings. The results indicate that, for a given group of high schools in the Board, the average annual energy consumption decreased from 2,228 MJ/m/sup 2//y in 1976/77 to 1,020 MJ/m/sup 2//y in 1978/79. Since the data presented cover a wide geographical area, it was necessary to take into account the number of annual heating degree days in the last five years for the various school locations, by including a summary of the annual heating degree days.

48856 **(NRC/BR—181) Annual energy consumption data on apartment buildings.** Elmahdy, A.H. (National Research Council of Canada, Ottawa, Ontario. Div. of Building Research). Jan 1982. 16p. (CE—01714). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

As part of an attempt to define appropriate energy consumption targets for different classes of buildings in Canada, this report contains data on the annual energy consumption of apartment buildings. These buildings are located in various towns and cities in Ontario and Quebec. A summary is provided of the sample size, the average, maximum and minimum floor areas and the energy consumption for the year in which the data were recorded. Plots of the energy consumption in GJ/m/sup 2//y versus the building area in m/sup 2/ area presented; however, no attempt has been made to correlate the annual energy consumption data with other pertinent variables. Although there was a slight reduction in the annual energy consumption of some of the Ontario Housing apartment buildings between 1975 and 1978, the cause of this decline in annual energy consumption was not specified. On the other hand, some of the other buildings in the same sample showed a small increase in annual energy consumption. These changes in energy consumption could be credited to one or more of the following factors: weather changes, degree of occupancy and vacancy within the builings, or implementation of energy conservation measures in the buildings: 7 figs., 7 tabs.

48857 **(NRC/BR—182) Recorded energy consumption data on office buildings.** Elmahdy, A.H. (National Research Council of Canada, Ottawa, Ontario. Div. of Building Research). Jan 1982. 10p. (CE—01713). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

As part of an attempt to define appropriate energy consumption targets for different classes of buildings in Canada, annual energy consumption data on groups of office buildings are provided in this report to demonstrate the pattern of energy consumption for this class of building. A summary is provided of the sample size, the average maximum and minimum floor areas, and the annual energy consumption for each group of office buildings. Complete listings of energy consumption and other relevant information are presented. Although no attempt has been made to correlate energy consumption data with other variables, plots of energy consumption in GJ/m/sup 2//y versus building floor area are shown. The variation of annual energy consumption according to floor area for about 80 office buildings, was surveyed by Ontario Hydro in 1974. A sample of 39 of these office buildings was resurveyed in 1977. There was a reduction in the annual energy consumption for 1977 compared to that for 1974 for some of the buildings. No explanation is given as to the cause of this decline. However, it could be credited to one or more of the following factors: weather changes, occupancy and vacancy patterns, or implementation of energy conservation programs. 4 figs., 8 tabs.

48858 **(NRC/BR—183) Annual energy consumption data on supermarkets in Ontario and Quebec.** Elmahdy, A.H. (National Research Council of Canada, Ottawa, Ontario. Div. of Building Research). Jan 1982. 7p. (CE—01715). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

As part of an attempt to define appropriate energy targets for different classes of buildings in Canada, this report provides a data base of actual energy consumption in supermarkets. The data were obtained from two well-known supermarket chains in Ontario and Quebec, and arranged in two groups. The annual energy consumption by supermarkets in Ontario and Quebec is reported in one group for the year 1977 only, whereas for supermarkets in the other group (located in Ontario) the annual energy consumption is reported for two consecutive years, 1987 and 1979. A summary is presented of the average, maximum and minimum floor areas and the energy consumption for both groups. The change in energy consumption between 1987 and 1979 is shown for those stores in Ontario in which the change was greater than or equal to 0.3 GJ/m/sup 2//y. 4 figs., 3 tabs.

48859 **(NRC/BR—NRCC20416) Basement heat loss studies at DBR/NRC [Div. of Building Research, National Research Council], DBR Paper No. 1045.** Mitalas, G.P. (National Research Council of Canada, Ottawa, Ontario. Div. of Building Research). Sep 1982. 62p. (CE—01663). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A simplified calculation method has been developed for predicting maximum rate of heat loss from a basement and the basement total heat loss over the heating season. This method differs from previous ones mainly because it recognizes the annual variation of basement heat loss as a significant component of the total basement heat loss. The development of the method is based on both experimental and analytical studies of basement heat loss. The essential data needed to calculate the basement heat loss are the steady-state and periodic shape factors, the amplitude attenuation factor and the time-lag factor and ground surface temperatures. The basement heat loss factors for several insulation systems as well as the ground temperature data for several locations in Canada are listed in the paper. A comparison of the calculated and measured basement heat loss values indicate that the method is capable of reasonably accurate prediction of basement heat loss. 23 refs., 21 figs., 9 tabs.

48860 **(ORNL—6401) Indoor air quality in 300 homes in Kingston/Harriman, Tennessee.** Hawthorne, A.R.; Aldrich, T.E.; Vo-Dinh, T.; Uziel, M.; Cohen, M.A.; Hamilton, C.B.; Orebaugh, C.T.; Miller, G.H.; Ironsides, K.; Monar, K.P. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 275p. NTIS, PC 09; 1; GPO Dep. Order Number DE88014607/JAW.

Supplemental indoor air quality measurements were conducted in the Kingston/Harriman area for radon, formaldehyde, polyn-

uclear aromatic hydrocarbons, and airborne micoorganisms. Eight groups of houses were chosen based on the presence or absence of the following sources: cigarette smoking, woodstoves, and kerosene heaters. Core measurements were made for a two{endash}week period in each house during the winter season again during the summer season. In addition, both vapor phase and particulate phase polynuclear aromatic hydrocarbons were monitored. Viable airborne bacteria and fungi were also sampled in a large subset of houses. Detailed energy use/weatherization surveys were conducted in 120 homes by utility trained auditors. Preliminary results indicate that mean winter radon levels were 2.4 pCi/L and mean summer radon levels were 1.3 pCi/L (excluding basement measurements). Mean formaldehyde levels were 0. 0444 ppm in winter and 0.065 ppm in summer. Polynuclear aromatic compounds were higher in homes with smokers, with levels positively related to the reported consumption of cigarettes. Higher levels of airborne bacteria and fungi were found indoors than outdoors, with approximately 50{percent} of the homes exhibiting concentrations greater than 1000 CFU/m{sup 3}. 51 figs., 81 tabs.

48861 **(PB—88-205760/XAB) Illinois state buildings energy expense study, FY 87 and projected FY 88-90.** Jones, D. (Illinois Dept. of Energy and Natural Resources, Springfield (USA). Building Efficiency Section). 2 May 1988. 35p. (IL/ENR/BE—87/02(88)). NTIS, PC A03.

See also PB—87-206322.

During FY 87 the State of Illinois spent more than $113 million for electricity, natural gas, coal, fuel oil, propane and steam to operate state-owned and -leased buildings. Over the next three years it is projected that this will increase to $130 million in FY90 due to increasing fuel costs. Although some of this cost growth could be eliminated by up-grading plants and equipment to more energy-efficient forms, present State of Illinois budget considerations generally will not allow the large capital expenditures required. The increase in energy cost, however, can be reduced by implementing low and no-cost operation and maintenance strategy changes. The Department of Energy and Natural Resources (ENR) State Buildings Energy Program (SBEP) is presently performing energy surveys of state buildings and training of facility personnel to accomplish this. In the report, the Dept. of Energy and Natural Resources (ENR) attempts to project energy costs for Illinois state buildings from FY88 through FY90. It also identifies energy usage and cost by fuel type and agency for FY83 through FY87.

48862 **(PB—88-206826/XAB) Potential of electrically operated heat pumps for heating water in South Africa, Research report.** Johannsen, A.; Kaiser, G. (National Mechanical Engineering Research Inst., Pretoria (South Africa). Heat Mechanics Div.). Aug 1986. 94p. (CSIR-RR—615). NTIS, PC E06/MF E06.

North American Continent sales only.

In a previous report (PB85-157337), the heating of water by means of electrically operated heat pumps was identified as offering a promising potential for saving energy in the Republic of South Africa. The report presents the results of investigations into the long-term performance of water-heating heat pumps (WHHPs) and their potential contribution towards the saving of energy. The investigations included an analysis of typical heat-pump systems, long-term monitoring of two heat-pump installations, the development of a performance model, simulation of performance in different regions of South Africa, as well as case studies of two industrial systems. Economic factors affecting the application of heat pumps are also discussed.

48863 **(PB—88-207535/XAB) Integrating energy and natural-lighting simulation: the DEROB (Dynamic Energy Response of Buildings) approach.** Higgs, F.S. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Building Research Inst.). 1987. 12p. (R/BOU—1435). NTIS, PC E04/MF E04.

North American Continent sales only.

A consensus was reached during the Second Dynamic Energy Response of Buildings (DEROB) user/expert conference held in Switzerland in January 1986 that the next logical step in the development of the DEROB system was the extension of the general thermal analysis of the system to express levels of natural light falling on a building's surfaces. Since the South African National Building Research Institute (NBRI) had already begun work on the project, it was given responsibility for the development. The paper discusses the approach by which the very comprehensive DEROB system has been extended to simulate natural lighting within buildings in a manner fully integrated with the existing thermal flux simulations. The new system offers scientists and designers a means by which they can successfully integrate these often conflicting design considerations into a building's design.

48864 **(PB—88-207618/XAB) EDT (Energy Design Technique): an expert advisor for energy design of passive and conventional buildings at the sketch design phase.** Hand, J.W.; Higgs, F.S. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Building Research Inst.). 1986. 13p. (R/BOU—1377). NTIS, PC E04/MF E04.

North American Continent sales only.

The use of comprehensive thermal-simulation tools in the early architectural design process is limited by economics and the demand for a full geometric description which does not reflect the generally limited data and budget available at that time. The Energy Design Technique (EDT), written for a 16-bit microprocessor and undergoing validation at the National Building Research Institute, offers a novel approach for design professionals. A building typology consisting of interrelationships, materials (including passive solar technologies), areas, orientations, and temperature/weather profiles is arrived at via a menu-driven program. A five-volume design can typically be described in less than 15 minutes, need not be complete, and may be readily altered to explore what if questions. EDT accesses an hourly energy-flow data base and outputs hourly energy balances for each component and space. The expert adviser capabilities of EDT are extended with a background program which uses hill-climbing techniques to search the design elements for sub-optimal thermal solutions.

48865 **(PB—88-210984/XAB) Air pollution in homes from use of kerosene heaters and gas heaters without exhaust.** Brunekreef, B.; Hoek, F.; Fisher, P.; Boleij, J. (Wageningen Gezondheidsleer (Netherlands)). Sep 1985. 31p. (In Dutch). (REPT—1985-229). NTIS, PC E03/MF A01.

The use of kerosene and gas heaters without exhaust in the home is on the increase, not only in the Netherlands but also elsewhere. The burning of kerosene and gas releases air pollutants. The concentration of such pollutants in the home can reach unacceptably high levels. This report reviews data in the literature and describes experiments. Convector-type gas and kerosene heaters produce large quantities of nitrogen dioxide. It is virtually certain that recommended levels prescribed for outside air in the Netherlands are exceeded by these types. Kerosene heaters equipped with a flame tube produce less nitrogen dioxide, but still enough to exceed recommended levels. Furthermore, kerosene heaters without exhaust also may cause unacceptable concentrations of sulfur dioxide in the home. The Health Board recently set up criteria which potential sources of air pollution must meet before being used in the home. None of the existing gas and kerosene heaters without exhaust meet these criteria, so that their use for heating homes and living spaces should be discouraged. an extensive bibliography is included at the end of the report.

48866 **(PB—88-213244/XAB) Safety considerations of energy-saving materials and devices. Technical report.** Mazzoni, S. (Underwriters Labs., Inc., Northbrook, IL (USA)). May 1978. 12p. NTIS, PC A03.

This report discusses how to judge the safety of products and materials being used to respond to national energy-conservation measures, as to design, installation, use, and maintenance. Two areas discussed are: the effect of adding insulation to building assemblies and how doing so could affect the fire resistances of wall and roof constructions and also possibly alter the flamespread characteristics of combustible interior finishes; and how more energy-efficient insulation might cause increased operating temperatures on exposed electrical wiring insulations and electrical-lighting fixtures. Also, some new and revived devices designed to provide cost benefits from an energy-consumption viewpoint are analyzed. Attention is given to automatic vent dampers; heat reclaimers; wood-burning stoves and wood- and coal-burning furnaces; and solid-fuel-fired, forced-air central furnaces.

48867 (PB—88-213319/XAB) Effects of thermal insulation on fire-resistive assemblies. Technical report. Schwartz, K.J. (Portland Cement Association, Skokie, IL (USA)). May 1981. 26p. NTIS, PC A03.

Guidelines are presented for determining the effects of added thermal insulation on the fire resistance of concrete wall and roof assemblies. When the fire resistance of a concrete assembly is governed by temperature-rise criteria, adding thermal insulation actually increases the fire resistance. If the fire resistance of the concrete assembly is controlled by structural criteria, adding thermal insulation usually will not change the fire resistance of the assembly. Research has shown that the addition of insulation in some fire-resistive assemblies can adversely affect performance. Evaluation of assemblies with increased levels of thermal insulation should be required by building officials to determine new hourly fire ratings.

48868 (PB—88-217054/XAB) Advanced desiccant materials assessment. Phase 2. Final report, November 1986-January 1988. Collier, R.K. (Enerscope, Inc., Glendale, AZ (USA)). Jan 1988. 73p. NTIS, PC A04/MF A01.

See also PB—87-172805.

The objective of the research was to quantify the relationships between desiccant matrix heat capacity, heat- and mass-transfer resistances, desiccant heat of adsorption and the desiccant isotherm shape. The authors approach to the problem was to perform computer simulations of cooling-system performance and to maximize that performance with respect to cycle time and regeneration fraction. Regeneration temperature was varied and results were compared to silica gel as a reference. In addition, various computer models were investigated with respect to numerical stability, convergence, ease of use, and time of execution. Investigations of computer models resulted in a model with a combination of features found in two other models. One was the program originally developed by SERI and the other was the MOSHMX program developed by Ian McClaine-Cross in Australia. All of the system results were obtained using this model. The superiority of the Type 1M desiccant material over more conventional desiccants was demonstrated. It showed less sensitivity to matrix heat capacity and heats of adsorption associated with practically-obtainable materials yielded near-maximum performance. It was also found that heat and mass transfer resistance affects all desiccant materials nearly equally and is not considered to be an important problem limiting system performance.

48869 (PB—88-217070/XAB) Advanced heat-pipe heat exchanger and microprocessor-based modulating burner controls development. Final report, January 1985-December 1987. Lowenstein, A.; Cohen, B.; Feldman, S.; Marsala, J.; Spatz, M. (TECOGEN, Inc., Waltham, MA (USA)). Feb 1988. 206p. (TE—4367-36-88). NTIS, PC A10/MF A01.

See also report dated Mar 87, PB—87-216008.

The work presented in the report includes: (1) the development of a heat-pipe condensing heat exchanger; (2) the development of a nominal 100,000-Btu/hr modulating air/gas valve; (3) the experimental performance studies of water/copper thermosyphons; (4) the field operation of a six-zone warm-air heating system; (5) the adaptation of a conventional venturi-type burner to modulation; and (6) the results of a one-day workshop for manufacturers of HVAC equipment on heat-pipe heat exchangers. Several of the accomplishments of the project included: A unique air/gas valve was adapted to furnaces with heat-pipe and drum-type heat exchangers, providing these furnaces with over a 5-to-1 turndown capability. A six-zone warm-air heating system was tested for two winters with the modulating furnaces previously described. A data base for the application of copper/water thermosyphons was started. A ten-tube heat-pipe heat exchanger was incorporated into a conventional clam-shell furnace as its second-stage condensing heat exchanger with only a small increase in the furnace's dimensions.

48870 (PB—88-218227/XAB) Recommended procedure for rating and testing of variable-speed air-source unitary air conditioners and heat pumps. Domanski, P.A. (National Bureau of Standards, Washington, DC (USA). Building Environment Div.). May 1988. 81p. (NBSIR—88/3781). NTIS, PC A05/MF A01.

A procedure is presented for testing and rating variable-speed, split residential air conditioners and heat pumps. The procedure is derived in part from existing procedures for single speed and two speed systems where these procedures could be applied, and introduces a new algorithm for representation of variable-speed unit performance in the intermediate speed operation range. Analysis and background which led to the formulation of the procedure are included as well as calculation examples for the cooling and heating mode. The procedure has been prepared for the Department of Energy for consideration in the rule making process.

48871 (PB—88-219993/XAB) Assessment of radiant and convective heaters for large commercial/industrial structures. Topical report, October 1986-May 1987. Gretsinger, K.M. (American Gas Association Labs., Cleveland, OH). Jun 1987. 71p. NTIS, PC A04/MF A01.

Radiant and convective heating equipment for large commercial and industrial structures are reviewed. Environmental issues unique to these structures, such as surface condensation, ventilation of fumes, and air stratification, are addressed. Design features and options of natural gas, oil, and electric equipment are described, comparing the advantages of various heater types. New convective gas heaters, which achieve efficiencies above 90%, by utilizing a fiber burner and a condensing heat exchanger, are shown to be a competitive heating option. Economics of various heating systems are evaluated. Results show that payback periods of 2 years or less are typically achieved through utilization of gas equipment. Case studies of several actual installations are discussed.

48872 (PB—88-220025/XAB) Free-piston Stirling Engine Development. Final report, January 1, 1986-December 31, 1987. Ackermann, R.A. (Mechanical Technology, Inc., Latham, NY (USA)). Apr 1988. 165p. (MTI—88TR36). NTIS, PC A08/MF A01.

See also PB—86-213980.

The free-piston Stirling engine (FPSE) is being developed as a potential gas-fired prime mover for heat applications in the residential market. The heat pump features an advanced FPSE coupled to a Rankine refrigerant compressor through a hermetically sealed diaphragm-activated hydraulic transmission. During the past two years the program has concentrated on developing the engine and compressor component to improve performance and reliability. The report presents the progress made during the period and the results of an independent test and evaluation performed on the Mark I heat-pump module by the HVAC manufacturer, Lennox Industries.

48873 (PNL—6587) Focus group discussions among owners and non-owners of ground source heat pumps. Roberson, B.F. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015147/JAW.

This research was sponsored by the Office of Buildings and Community Systems and conducted by the Pacific Northwest Laboratory as part of an ongoing effort to enhance the commercial use of federally developed technology. Federal dollars have supported research on the development of ground source heat pumps (GSHP) for several years. Though several companies currently sell GSHP's for residential use, their share of the total heating and air conditioning business remains less than one percent. Large manufacturing companies with national distribution have not yet added GSHP equipment to their product line. GSHP's use only about one half (Braud 1987) to one third (Bose 1987) of the energy needed to operate conventional furnaces and air conditioners. Consequently, a high level of market penetration by the GSHP offers direct benefits to both utility companies and individual users of the systems. Widespread use of these highly efficient systems will reduce both total energy consupmtion, and problems associated with high levels of energy use during peak periods. This will allow utility companies to delay capital expenditures for new facilities to meet the growing energy demand during peak periods. The cost effective use of electricity also reduces the likelihood of homeowners switching to a different fuel source for heating. 5 refs.

48874 **(PNL—6610) Prototype dining hall energy efficiency study.** Mazzucchi, R.P.; Bailey, S.A.; Zimmerman, P.W. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 140p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88013881/JAW.

The energy consumption of food service facilities is among the highest of any commercial building type, owing to the special requirements for food preparation, sanitation, and ventilation. Consequently, the US Air Force Engineering and Services Center (AFESC) contracted with Pacific Northwest Laboratory (PNL) to collect and analyze end-use energy consumption data for a prototypical dining hall and make specific recommendations on cost-effective energy conservation options. This information will be used to establish or update criteria for dining hall designs and retrofits as appropriate. 6 refs., 21 figs., 23 tabs.

48875 **(PNL-SA—15382) A critical examination of ducted mechanical ventilation in new residential housing in the Pacific Northwest.** Parker, G. B. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1988. Contract AC06-76RL01830. 28p. (CONF-880679—). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014755/JAW.

From 81. annual meeting of Air Pollution Control Association; Dallas, TX, USA (1 Jun 1988).

Several programs have been undertaken in the Pacific Northwest Region to demonstrate new energy-efficient housing construction practices. These programs, sponsored by the Bonneville Power Administration (BPA), have spawned the construction of hundreds of tight, energy-efficient single-family, multifamily, and manufactured homes that are equipped with mechanical ventilation equipment, primarily a whole-house air-to-air heat exchanger (AAHX). The design and installation of an AAHX is a new and developing technology in the Northwest. Although builders received instruction and guidance in installing an AAHX, field data indicates that many of the early installations did not perform as designed. Specifically, in many dwellings, the location of fresh air intake and exhaust ducts was less than optimum, resulting in exhaust air being pulled into the dwelling through the fresh air intake. This paper critically examines AAHX installations in several dwelling types. Field data taken in two energy-efficient manufactured homes showed a significant improvement in fresh air exchange rate after relocating the exhaust air duct of the AAHX in each home. The whole-house air exchange rates, measured by tracer gas, increased by greater than 50{percent} in each home after the exhaust ducts were moved away from the intake ducts. The duct relocation significantly reduced the probability of contaminated air entering the fresh air intake duct. This experiment has led to developing improved proposed guidelines for design and installation of mechanical ventilation equipment in energy-efficient manufactured homes. 23 refs.

48876 **(SC—121982) Study of the ratios of glass area to window framing area for common types of windows used in new construction.** (Scanda Consultants Ltd., Ottawa, Ontario (Canada)). Dec 1982. 16p. (CE—01723). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents the methodology and results of a study aimed at determining the relationship between glazing area and frame area for common residential windows. This was undertaken to specify more precisely the building envelope areas for solar gain and heat loss analyses. The study shows that most windows are made up of about 70% glass and 30% framing, regardless of make and type. An exception to this is the bay window which has more glass area as a fraction of the rough opening, due to its shape. In the latter case, the glass area is about 90% of the rough opening. Methods of integrating these findings into the CMHC-2 computer program are discussed. 12 tabs.

48877 **(SERI/TP—254-3380) Impacts of advanced refrigerator insulation.** Potter, T.F.; Benson, D.K.; Smith, L.K. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1988. Contract AC02-83CH10093. 14p. (CONF-880814—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88001180/JAW.

From Summer study on energy efficiency in buildings; Pacific Grove, CA, USA (28 Aug 1988).

Recent developments in advanced insulations, such as powders under a soft vacuum (R = 20 per inch), and hard-vacuum insulation with spacers (R = 15 per 0.1 inch), merit evaluating their practical uses. Refrigerator/freezers (R/Fs) are well-suited for incorporating the new insulations for the following reasons: the energy consumption of R/Fs must be reduced to comply with the National Appliance Energy Conservation Act (NAECA) standards; the Montreal Protocol to Control Ozone-Depleting Substances calls for a reduction in chlorofluorocarbons (CFCs) that are now used in the insulative foams in R/F sidewalls; and both high R-values to minimize heat gain through the walls, and thin walls to maximize the interior volume, are desirable. We selected two different R/F base-cases for this analysis; one had the typically used CFC foam (R = 7.7 per inch), while the other featured non-CFC foam (R = 5.3 per inch) in the exterior walls and doors. (In keeping with industry practice, both refrigerator doors were insulated with fiberglass.) Two simulated modifications of both of the base cases, based on the DOE closed-door test, included replacing part of the wall and door insulation with either 1 inch of powder or a 0.1 inch layer of hard vacuum/spacer insulation. Both of these modifications met the standard, even when the non-CFC foam base case was simulated. 13 refs., 5 figs.

48878 (SU/ME—1981, pp 14) **Air treatment for control of contaminants in buildings.** 1988. Saskatchewan Univ., Saskatoon (Canada). Dept. of Mechanical Engineering. (CE—01691).

In Research needs on carbon dioxide and air treatment relating to air quality.

The removal of indoor contaminants by dilution with outdoor air requires a considerable amount of energy to condition that air. Removing the contaminants from the recirculated air permits the use of a minimum amount of fresh air. A ventilation air cleaner capable of controlling all forms of contaminant does not exist. Air treatment devices must be placed in series to remove the contaminants produced in a building. There are two classes of air treatment devices evaluated in the paper: those suitable for treating ventilation air in buildings and industrial air cleaners. Filters, including electronic air cleaners, are used for the removal of particulate matter from ventilation air. They are commonly used and are well documented in the literature. Air washers (scrubbers) have been primarily used for humidification but can act as effective contaminant removal devices. Their effectiveness is increased with the addition of chemicals to the water. Removal or killing of live microorganisms in air can be done with high efficiency particulate filters or ultraviolet lights. Two common commercial gas and vapor adsorbers are activated carbon and potassium permanganate impregnated activated alumina. Both have proven effective in removing gases and vapors. Industrial air cleaners may be suitable for ventilation air cleaning under the certain circumstances. Strategies have been proposed to minimize outdoor air requirements for ventilation and it remains to test these strategies in building operations. 16 refs., 1 fig., 2 tabs.

48879 (SU/ME—1981, pp 9) **Carbon dioxide in buildings as related to air quality and ventilation requirements.** 1981. Saskatchewan Univ., Saskatoon (Canada). Dept. of Mechanical Engineering. (CE—01691).

In Research needs on carbon dioxide and air treatment relating to air quality.

The generation of carbon dioxide in buildings is easily calculated. This permits the determination of the outdoor air quantity required to maintain a fixed indoor concentration of carbon dioxide. To maintain the recommended threshold limit value (TLV) of 2,500 ppM of outdoor air per person are required. Measurements of the carbon dioxide concentration in schools with reduced quantities of outdoor air showed that it remained at levels below the TLV or exceeded it for only short periods. Similar measurements in an office building and eight energy efficient houses showed the same results. There appears no need to consider CO/sub 2/ as a serious pollutant in buildings. Carbon dioxide has been used as an indicator of indoor air quality. Sensing its concentration permits minimizing the outdoor air required for contaminant dilution and hence the energy requirement for its conditioning. The CO/sub 2/ level was

used to modulate the outdoor and bypass dampers in an energy efficient Helsinki office building at 70 to 800 ppM. Energy savings were reported as 40%. In the USA, a small school had a numer of CO/sub 2/ sensing points installed and the concentration was maintained in the range of from 1,000 to 2,000 ppM. A computer study predicted an energy saving of 20% using the system. Both control systems were removed after the tests so further development appears to be needed. There is some doubt as to whether CO/sub 2/ is a satisfactory measure of indoor pollution as other indoor pollutants could dominate in some situations. 17 refs.

48880 (VE—1501) Report on development of an Alberta weather input data base for Alberta Energy and Natural Resources. (Vinto Engineering Ltd., Edmonton, Alberta (Canada)). Feb 1985. 179p. (CE—01786). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The purpose of this research project is to develop an Alberta weather, climate input data base that is compatible with a variety of available computer programs. The Alberta climate data base was developed by utilizing eight weather stations which represent the various climatic regions of the province. The weather data base has been extensively tested on four computer programs, two comprehensive and two simplified energy analysis programs. The programs were run using the same building model and the energy consumptions calculated at each weather site were comparatively analyzed. The test results verify the compatability between the weather data base and the four programs tested. Research findings indicate that the effect of the weather data base on a building's energy consumption is consistent. The degree of accuracy of the energy consumptions calculated by the different computer programs for each weather station was found to be within +/- 5%. Further investigation revealed that the compatability of the Alberta weather data base with the majority of energy analysis programs on the market today is achievable. 7 tabs.

48881 (ORNL/tr—88/12) Current status and trends in compressor development: 1, Recent research on positive-displacement type refrigerant compressors. Shimizu, Takashi; Yanagisawa, Tadashi. Translated from *Reito ;* **62**: No. 720, 8-14(Oct 1987). Contract AC05-84OR21400. 19p. Q/MF A01; 1; GPO Dep. Order Number DE88008607/JAW.

Refrigerant compressors, which are the heart of refrigerators and air conditioners, are no exception, and efforts have been made to increase performance and efficiency by using today's advanced production, electronic, and computer technologies. As a result, various attempts have been made to improve the performance of reciprocating, rotary, scroll, screw, and turbo compressor types, and these compressors are now beginning to be selectively used according to the specific application so as to take advantage of the characteristics of the various compressors. In addition, evaluations are being made of capacity control through changes made in the number of rotations, the use of refrigerant mixtures, and interaction between refrigerating oil and refrigerant, so as to improve performance as regards general operation, reliability, and control in cases in which an entire air conditioning and refrigeration system, including compressors, is considered as a system. With regard to positive-displacement type refrigerant compressors, the authors, in the present report, have investigated the research that has been published recently and have tried to identify trends.

48882 A comparison of building thermal performance models using measured data. Busch, J.F. (Lawrence Berkeley Lab., Berkeley, CA (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **92**: No. 2A, 537-549(1986). (CONF-8606125—).

From ASHRAE annual meeting; Portland, OR, USA (22 Jun 1986).

Technical Paper NO. 3011.

Three different types of building thermal performance models are compared: dynamic, steady-state submeter, and steady-state utility bill level. Corresponding to these are three models in common usage in the field: the equivalent thermal parameters approach (ETP), the Buildings Energy-Use Compilation and Analysis method (SUBMET), and the Princeton Scorekeeping Method (PRISM). The models are applied to data from a subset of passive solar houses from the SERI Class B project. The ten houses used are located in the Northeast, Southeast, Midwest, and West, are all served by electric resistance heating, and have crawlspace or slab-on-grade ground coupling. The data include hourly values for indoor and outdoor temperatures, solar radiation, and energy inputs for heating, domestic hot water, and appliances. These data are aggregated according to the needs of the particular model used. The derived parameters compared include an overall building load coefficient, balance temperature, baseload, thermal capacity, time constant, and equivalent south-facing window area. Model results show fairly good agreement among parameter estimates, especially for houses located in colder regions. The errors associated with the parameters are generally larger in warmer climates. Heat loss coefficients determined by an in situ method (called "co-heating" were consistently higher than those from the models studied. The building time constant was a more reasonable indicator of building thermal inertia characteristics than the thermal capacitance. Equivalent south-facing window areas average only about one-third of the actual amount.

48883 Infiltration degree-days: A statistic for quantifying infiltration-related climate. Sherman, M. (Energy Performance of Buildings Group, Indoor Environment Program, Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **92**: No. 2A, 161-181(1986). (CONF-8606125—).

From ASHRAE annual meeting; Portland, OR, USA (22 Jun 1986).

Technical Paper 2986.

A new statistic, Infiltration Degree-Days (IDD), is introduced by quantifying the climatic conditions that influence infiltration. The well-known energy statistic, Degree Days (DD), is used to indicate the severity of climate relative to the conduction load through the building envelope (usually during the heating season). Infiltration Degree-Days (IDD) serves the same function for calculating infiltration and infiltration-related processes that standard degree-days has served for calculating conduction and conduction-related processes. Although standard degree-days is often used to estimate the entire load (i.e., conduction, radiation, and infiltration), it is calculated assuming a linear energy-flow relationship. IDD is designed to overcome the inaccuracies inherent in using standard degree-days for processes like infiltration that are nonlinear (in temperature and other climatic variables); they also potentially solve the problems associated with the use of degree-day formalisms for calculating cooling loads or any situations where the determination of latent heat is a problem. This report presents parallel derivations for standard and infiltration degree-days and includes formulas for determining the base temperature (and enthalpy) methods similar to the many variable-based degree-day methods currently in use for envelope-dominated structures. Also included are tables of heating and cooling IDD for various cases and selected cities in North America.

48884 Residential energy simulations in the pacific northwest: A comparison of four widely used models. Akbari, H.; Conner, C.C.; Usibelli, A.J. (Energy Efficient Buildings Program at Lawrence Berkeley Lab., Berkeley, CA (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **92**: No. 2A, 145-160(1986). (CONF-8606125—).

From ASHRAE annual meeting; Portland, OR, USA (22 Jun 1986).

Technical Paper 2985.

The limitations and applicability of four different residential building energy simulation models at different levels of sophistication have been examined and compared. These models are: 1. the Standard Heat Loss Methodology (SHLM); 2. SUNDAY, a microcomputer based energy simulation model; 3. WORK4, a temperature bin method of heat loads calculation; and 4. DOE-2, a state-of-the-art public domain building energy simulation model. The comparisons were performed over a wide range of parametric conditions including changes in climate, inside temperatures, internal gains, and UA. The authors found reasonably close agreement between the WORK4 and SUNDAY models. These two models were

also in reasonable agreement with DOE-2, except when modeling well-insulated homes and air infiltration changes. The SHLM model yielded substantially lower energy use estimates than the other models. In addition, the simulation results for both WORK4 and SUNDAY were collapsed into a smooth trend using a normalization procedure. This simple trend is solely defined by climatic conditions.

48885 **Residential prototype thermal load comparisons and variations with geographic location.** Sullivan, R.; Huang, Y.J.; Turiel, I.; Ritschard, R.L.; Bull, J.L. (Applied Science Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **92**: No. 2A, 133-144(1986). (CONF-8606125—).

From ASHRAE annual meeting; Portland, OR, USA (22 Jun 1986).

Technical Paper 2984.

Thermal load comparisons of five residential prototypes are presented along with a discussion of the implications associated with varying geographic locations. The work represents a continuation of previous work accomplished, which showed the independence of climate when comparing the thermal load variations caused by various configuration changes. The analysis used a data base of DOE-2.1A computer simulations for five building models (one-story ranch, two-story, split level, middle-unit townhouse, and end-unit townhouse), with a climatic base of 17 locations. Also investigated were the differences associated with three floor types: slab-on-grade, basement, and ventilated crawl space. Results indicate that the thermal loads of different prototypes are proportional to each other in a manner that is independent of geographic location. In addition, percent heating and cooling load changes for a particular prototype resulting from implementation of a conservation measure are also approximately constant with location.

48886 **Advanced versions of heat pumps with zeotropic refrigerant mixtures.** Radermacher, R. (Dept. of Mechanical Engineering, Univ. of Maryland, College Park, MD (US)). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **92**: No. 2A, 52-59(1986). (CONF-8606125—).

From ASHRAE annual meeting; Portland, OR, USA (22 Jun 1986).

Technical Paper 2977.

Two heat pump cycles operating with halogenated hydrocarbon mixtures are considered. Each cycle promotes vastly extended ranges of capacity control by composition shift. Further the Coefficient of Performance increases up to 50% under extreme temperature lifts when reciprocating compressors are employed. This is due to a reduction of the pressure ratio by a factor of more than two.

3202 Transportation

REFER ALSO TO CITATION(S) 48136, 48409, 48410, 48411, 48412, 49349

48887 **(AD—27031982) CANCAR. A study of automobile origin-destination trips for Canada, 1978,1979,1980.** Geer, J.A.; Mason, H.; Penner, R. (Environmental Law Centre, Edmonton, Alberta (Canada)). 27 Mar 1982. vp. (CE—01707). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study uses the CAROD model on a new Canadian network coded from provincial traffic counts on highways to produce a complete set of automobile origin-destination person-trip data for the years 1978, 1979, and 1980. It has been applied to data sets for British Columbia, a national network using data from the Canadian Transport Commission, and to Ontario using traffic volume counts from the province. As a result of these studies, it has been shown that the model can duplicate the large survey values, that a complete set of O-D can be produced which unambiguously represents the best fit to observed traffic volumes within the framework of a shortest path gravity model. Many variations of the model were studied and the final results were produced by a partitioned network, one including links in Ontario and Quebec and the other including links from the West and the Maritimes. 2 figs.

48888 **(BNL—41434) Design approaches and parameters for magnetically levitated transport systems.** Danby, G.T.; Powell, J.R. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 30p. (CONF-880466—10). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014286/JAW.

From Conference on superconductivity and applications; Buffalo, NY, USA (18 Apr 1988).

Mechanically levitated transport system approaches are assessed with regard to thrust power needs, track cost, suspension stability, and safety. The null flux suspension appears as the favored approach, having the least thrust power requirements, highest stability, and lowest amount of track material. Various null flux configurations are described together with their operating parameters. The Linear Synchronous Motor (LSM) propulsion system is also described for propelling the suspended vehicles. Cryogenics and superconductivity aspects are discussed and the effect of high T/sub c/ superconductors evaluated. 13 refs., 16 figs., 2 tabs.

48889 **(EMR/OERD—84-04E) Report on the review of the New Liquid Fuels Task and Task coordinator's response.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Office of Energy Research and Development). 1984. 104p. (CE—01734). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This paper reviews research and development programs in alternate transportation fuels under the Office of Energy Research and Development, Ministry of Mines and Resources Canada in 1984. The research included such alternate fuels as propane, compressed natural gas, coal liquefaction, fuels from biomass, hydrogen, and lithium/iron sulphide batteries. After surveying the work carried out, the review team made a total of 16 recommendations, directed at the Task coordinator, to assist future developments in the alternative transportation fuels area. These recommendations included policy recommendations, covering the Task as a whole, and technical recommendations, referring to specific programs within the Task. 258 refs.

48890 **(JAPA—TE83-17) Energy contingency planning in transportation. Final report. Phase 1.** Parviainen, J.A. (Parviainen (Jouko A.) and Associates, Oakville, Ontario (Canada)). Jul 1983. 102p. (CE—01752). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study has the objectives: to examine several transportation contingency measures and assess their effectiveness in various energy shortage situations in Canada, especially by referring to previous contingencies; and to develop methods of testing, by surveys or panels, the responses of transport operators and users to selected measures. The US experience with oil shortages is examined and assessed, showing that a consensus about the effect of past US actions has emerged, and a new set of strategies has emerged. This involves use of strategic reserves to smooth out initial impacts, and implementation of updated earlier plans by governments below the federal level. Public input is seen to be valuable in this regard, but lack of public participation in the planning process is evident. Canada's emergency response setting is different and shows a significant opportunity to develop a response capability that will be flexible and allow the management of a variety of shortage circumstances. Lists of selected contingency measures are presented for urban, intercity, and freight transportation and are evaluated by; priority. Two shortage scenarios are used to examine assessment of measures; the criteria for assessment are outlined and include fuel and cost savings, ease of implementation, and public acceptance. Design philosophy and survey methods are suggested for investigating attitudes of automobile owners, urban transit operators, freight carriers, and others; participatory workshops and household panels are also considered as means of assessing contingency plans and education about such plans. 19 refs., 15 figs.

48891 **(LEMA—23-80-8) The potential for vanpooling in Manitoba.** Ludwick, E.M. (Ludwick (E.M.) and Associates, Winnipeg, Manitoba (Canada)). May 1984. 35p. (CE—01740). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This document is the final report on the vanpooling demonstration project funded under the Manitoba/Canada Conservation and Renewable Energy Demonstration Agreement CREDA. The project was undertaken in 1982 and early 1983, with the aim of clearly showing the energy conservation advantages of vanpooling and thereby attempting to gain widespread adoption of the concept. Basic steps in the project included concept promotion, education, site-specific technical evaluation, vanpooling implementation and program evaluation. Vanpooling was not considered to be feasible for the five organizations for which technical evaluations were conducted, primarily because of insufficient residence clustering of long-distance commuting employees within individual firms. It was not possible to implement any vanpools within the scope of the demonstration project, but the vanpooling alternative would likely be of interest to new or growing organizations employing more than a thousand persons at a given location, on a given shift. Measures should be taken to ensure that future energy-conservation opportunities through vanpooling are captured. These include legislative amendments, the demonstration of third party vanpool concepts, commuter-oriented marketing efforts and the commitment of ongoing resources to inform and assist potential future vanpoolers and vanpool sponsors. 9 refs.

48892 **(MEM—22-81-83) Route optimization study. Rural & urban distribution systems.** (Manitoba Ministry of Energy and Mines, Winnipeg (Canada)). Feb 1984. 66p. (CE—01806). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

One of the most expedient methods to save transportation dollars is to conduct a route optimization analysis. Simply stated, route optimization is a process of tailoring a company's route system to result in the most cost effective way of meeting their transportation needs. One specific benefit of route optimization is that of energy savings through reduced fuel consumption. The study outlined in this report was undertaken to demonstrate the potential energy savings of route optimization. The study was conducted in two phases; rural distribution system and urban distribution system. The system studied consisted of 10 routes collecting milk from 77 producers and the delivery of it to the processing plant. Four trucks handled the routes. Through removal and reassigning of routes as well as increased truck capacity, mileage and fuel consumption were significantly reduced. 6 refs., 8 tabs.

48893 **(ORNL/CSD/TM—258) Scheduling Algorithm for Improving Lift (SAIL): Phase 1, documentation.** Hawthorne, J.E.; McLaren, R.A. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 140p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88015373/JAW.

The Military Sealift Command, a component of the United States Transportational Command, is responsible for the Sealift of military personnel and material during a crisis. Conceptual plans for these complex moves, called "deliberate plans," are continually being prepared. A computer-based scheduling system, the Sealift Strategic Analysis Subsystem (SEASTRAT), is under development for assisting on the production of these plans. The ship scheduling portion of this system, the Scheduling Algorithm foe Improving Lift (SAIL), combines linear optimization and heuristic methods to determine ship routes and cargo loadings which honor a variety of complex operational constraints. 13 refs., 2 figs., 2 tabs.

48894 **(PB—88-207519/XAB) Fuel conservation: the key alternative source of energy.** Uken, E.A. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Transport and Road Research). Aug 1986. 22p. (CSIR-RR—461). NTIS, PC E04/MF E04.

North American Continent sales only.

The Republic of South Africa is the envy of most oil-importing nations in that it has many options open to it in the event of oil embargoes, shortages, or price hikes. The alternative local sources such as oil-from-coal, methanol, ethanol, esterified sunflower-seed oil and gas oil are briefly discussed. The cheapest alternative source of them all is, however, conserving whatever fuel is available. This option is therefore considered in more depth with special reference to practices in traffic management, transport planning, choice of vehicles and their judicious use. It is concluded that much more needs to be done to educate and encourage the motoring public to conserve fuel.

48895 **(PB—88-207527/XAB) Conservation of liquid fuels used in road transportation.** Dehlen, G.L. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Transport and Road Research). Aug 1986. 13p. (CSIR-RR—462). NTIS, PC E04/MF E04.

North American Continent sales only.

The Government's strategy on energy conservation, the case for reducing the consumption of the liquid fuels used in road transportation, and means of achieving this with minimum negative effects on the economy, are examined. A conservation objective is proposed. Possible conservation measures relating to transport demand, transport and traffic management, roads, vehicles, and drivers are listed. The potential savings achievable are estimated, and contrasted with the costs and other disbenefits. Procedures for evaluating candidate measures and selecting the best set are proposed. Promising measures requiring further research and development before they can be implemented are identified. The need for monitoring progress towards achieving the objective is stressed.

48896 **(PB—88-207758/XAB) Influence of road-surface properties on fuel consumption.** Shear, D.; Hugo, F.; Visser, A.T. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Transport and Road Research). Aug 1986. 20p. (CSIR-RR—449). NTIS, PC E04/MF E04.

North American Continent sales only.

Experiments were conducted to evaluate the effect of road-surface characteristics on the rolling resistance of two passenger cars as part of a program to quantify vehicle operating costs as a function of road condition. The coast-down technique was used and proved to be practical, producing repeatable results. Regression models were developed to predict the rolling-resistance coefficients in terms of factors such as tire temperature, road surface texture and road roughness. A comparison of fuel consumption obtained by dynamometer simulation with a simplified prediction model illustrated that the latter would be adequate for planning purposes, but for detailed fuel consumption studies a simulation technique incorporating an engine torque/fuel consumption map would be required.

48897 **(PB—88-207766/XAB) Effects of road improvements on fuel consumption of buses: case study.** Schermers, G. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Transport and Road Research). Aug 1986. 18p. (CSIR-RR—450). NTIS, PC E04/MF E04.

Summary in Afrikaans; North American Continent sales only.

This paper details the effect of road improvements on the fuel consumption of two single deck buses in the Amaotana region of Durban. It provides two regression models for estimating fuel consumption on gravel and asphalt roads. The variables included in each model are distance, time, number of passengers and number of stops. The report deals only with fuel consumption; vehicle operating costs are not discussed. Fuel consumption can be estimated by the models if the need arises to predict the benefit of surfacing and upgrading a gravel road. It is concluded from the case study on a road in rolling terrain that bus fuel consumption may be reduced by 20 to 30 percent as a result of surfacing a gravel road, with the normal accompanying improvement in geometrics.

48898 **(PB—88-208079/XAB) Tests used in Project Level Flexible Pavement rehabilitation studies. Research report.** Jordaan, G.J. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Transport and Road Research). Sep 1986. 33p. (CSIR-RR—445). NTIS, PC E05/MF E05.

Summary in Afrikaans.

This paper gives guidelines for the use of tests and their interpretation in the various phases of flexible pavement rehabilitation design as currently adopted in South Africa. The procedure advocated involves a systematic approach to the investigation, evaluation and analysis of the existing pavement. In the recommended procedure, use is made of past pavement behavior and pavement condition, thereby making possible an early assessment of additional information needed. Much emphasis is placed on the optimum utilization of available resources in designing the best applicable remedy to an existing problem. The paper gives a comprehensive list of criteria for parameters measured on a routine basis on South African roads. The procedure suggested allows the condition of pavements to be expressed in comparable terms. Information on the development and use of some new and specialized tests which are used in pavement rehabilitation is given in an appendix.

48899 **(PB—88-208574/XAB) Vehicle operating costs: evidence from developing countries.** Chesher, A.; Harrison, R. (International Bank for Reconstruction and Development, Washington, DC (USA)). 1987. 381p. NTIS MF E06.

Library of Congress catalog card no. 87-22178.; Microfiche copies only. Paper copy available from World Bank, 1818 H St., NW, Washington, DC 20433.

The document presents information concerning the relationships between vehicle operating costs and highway conditions derived from four studies performed in Kenya, the Caribbean, Brazil, and India in the 1970s and early 1980s. The levels of transport costs and the amounts by which they are altered when highway conditions change depend on two main factors. The first is the production technology facing firms, in particular, the types and designs of vehicles to which firms have access. The second is the economic environment that firms face, in particular, relative prices of inputs to the production of transportation, such as fuel, tires, labor, and vehicles, and the nature of the transport markets that firms serve. The first part of the book sets out an economic model of firms managing vehicle fleets within which these influences can be examined. The second part of the book reports and interprets the results of the four major research projects which were designed to study the influences on vehicle operating costs. The third part of the book examines total vehicle operating costs.

48900 **(PB—88-208590/XAB) Vehicle speeds and operating costs: models for road planning and management.** Watanatada, T.; Dhareshwar, A.M.; Lima, P.R.S.R. (International Bank for Reconstruction and Development, Washington, DC (USA)). 1987. 461p. NTIS MF E06.

Library of Congress catalog card no. 87-22176.; Microfiche copies only. Paper copy available from World Bank, 1818 H St., NW, Washington, DC 20433.

A study using an aggregate-mechanistic view of vehicle speed and operating costs under free-flow conditions was undertaken by the World Bank to aid in road-transport investment planning. Vehicle speed and operating cost prediction models were developed. The models were estimated using the comprehensive data base collected in the Brazil-United National-World Bank highway research project and were validated along with data sets from India. The models cover the force-balance relationship, steady-state speed, micro non-transitional speed, micro transitional speed, aggregation, fuel consumption, and vehicle maintenance, depreciation, interest, and utilization. Guidelines are provided for implementing the model on mainframe or microcomputers.

48901 **(PB—88-213988/XAB) Shared-ride taxi feeder service in Memphis, TN. Final report, May 1983-October 1984.** Cooper, N.G. (COMSIS Corp., Wheaton, MD (USA)). Mar 1988. 161p. NTIS, PC A08/MF A01.

From May 1983 through October 1984, the Memphis Area Transit Authority (MATA) conducted the Taxi Feeder Demonstration Project. It entailed the operation of fixed-route feeder services through three low-density neighborhoods and one industrial park, connecting them to the public bus system. These feeder services, called the Neighborhood Shuttle, were operated by private suppliers, who were selected by competitive bid on a route-by-route basis, under contract to the transit authority. The private contractors operated a total of five to ten passenger vehicles along the system of shuttle routes. A grant received from the U.S. Department of Transportation under its Service and Methods Demonstration Program funded the project. Neighborhood Shuttle service was implemented as a low-cost way to provide minimal transit service to low-demand, low-density areas. Based on available information, it would appear that privately contracted shuttle service is less costly to operate than conventional MATA fixed-route bus on a total cost basis, but more expensive on a cost per passenger basis.

48902 **(PB—88-214622/XAB) Results from the car-coupling impact tests of intermodal trailers and containers. Final report, 1985-1987.** Johnson, M.R. (IIT Research Inst., Chicago, IL (USA)). Mar 1988. 39p. (IITRI-P—06054). NTIS, PC A03/MF A01.

Results are presented from car-coupling impact and lift/drop tests conducted in April 1985 under the Safety Evaluation of Intermodal and Jumbo Tank Hazardous Material Cars Program. The program was conducted to develop information for analyzing the safety of transporting hazardous material containers by rail in trailer-on-flat-car or container-on-flat-car service. The 106 car-coupling impact tests included 10 different arrangements of cargo tanks (tank trailers) and intermodal tank containers mounted on a flat car. No tendency for trailers or containers to become dislodged during impact was observed, properties of end-of-car cushioning devices were found to be different at each end of the car, and drop tests caused significant damage to support legs of the tank trailers.

48903 **(PB—89-215314/XAB) Key decisions in urban transportation public-private cooperation. Final report.** Shaw, P.L. (California State Univ., Long Beach (USA)). May 1988. 151p. NTIS, PC A08/MF A01.

See also PB—86-103694.

The purpose of the study is to identify the policy mechanisms and actions that represent key decisions in public-private sector cooperation in urban mass-transportation service delivery. To accomplish the study purpose, certain policy questions were explored. (1) How did the public-private relationship develop to its current form. (2) What is the framework of planning and service. (3) How is the private sector involved. (4) What barriers hinder private sector involvement. (5) What practical intergovernmental steps would enhance private sector involvement.

48904 **(PB—88-216569/XAB) Effects of an uncrushed base layer on pavement performance. Final report.** Johnson, E.G.; Hicks, R.G. (Alaska Dept. of Transportation and Public Facilities, Fairbanks (USA). Research Section). Jun 1987. 37p. (F—27302). NTIS, PC A03/MF A01.

See also PB—83-152033.

In 1974, the Alaska Department of Highways decided to save money and fuel by removing the base course and placing the asphalt-concrete surface directly on the surface of the Glenn Highway Widening project. The original two lanes had been constructed with a crushed-base course in 1969, thus providing an excellent comparison of the performance of the two bases. Results showed that the uncrushed base course performed better than the crushed-base course: the resilient modulus was higher and the permanent deformation was lower. The uncrushed base is apparently superior because of a larger maximum particle size and greater maximum density. An analysis of the future performance of the roadway with equal thickness of asphalt indicates that the pavement over the uncrushed base would have a longer life than the pavement over the crushed base by 54%.

48905 **(PB—88-218326/XAB) Pavement management and weigh-in-motion. Transportation research record.** Cation, K.A.; Shahin, M.Y.; Scullion, T.; Lytton, R.L.; Butt, A.A. (National Research Council, Washington, DC (USA). Transportation Research Board). 1987. 155p. (TRB-TRR—1123). NTIS, PC A08/MF A01.

See also PB—86-245412; Library of Congress catalog card no. 88-1479.

The 15 papers in the report deal with the following areas: development of a preventive maintenance algorithm for use in pavement-management systems; pavement-performance prediction model using the Markov Process; roadway modeling and data conversion for a transportation-facilities information system; development of a methodology to estimate pavement maintenance and repair costs for different ranges of pavement-condition index; new techniques for modeling pavement deterioration; pavement management at the local government level; a comprehensive ranking system for local-agency pavement management; expert system as a part of pavement management; MAPCON: a pavement-evaluation data-analysis computer system; a microcomputer procedure to analyze axle load limits and pavement damage responsibility; selected results from the first three years of the Oregon automatic monitoring demonstration project; automated acquisition of truck-tire pressure data; calibration and accuracy testing of weigh-in-motion systems; accuracy and tolerances of weigh-in-motion systems; on-site calibration of weigh-in-motion systems.

48906 **(PB—88-218847/XAB) Maintenance manager's manual for small transit agencies. Special report 1985-1986.** Fowler, W. (Ohio Dept. of Transportation, Columbus (USA). Div. of Public Transportation). Mar 1988. 200p. (ODOT-DPT—017). NTIS, PC A09/MF A01.

This publication contains information to assist operators of transit agencies providing public transportation in rural and smaller urban areas to better manage their vehicle maintenance programs. The report includes discussions of maintenance management, maintenance programs preventive maintenance, recordkeeping, selection of type of maintenance operation, in-house maintenance, and maintenance practices. Also included are appendixes giving supplementary information about tire loads; lubrication oil; mechanic hand tools; shop tools; mechanic aptitude tests; technical training resources; maintenance management training resources; and lists of manufacturers of air-conditioning systems, wheelchair lifts and wheelchair ramps.

48907 **(PB—88-219134/XAB) Recent ride-sharing research and policy findings. Transportation Research Record.** Mehranian, M.; Wachs, M.; Shoup, D.; Platkin, R.; Beroldo, S.J. (National Research Council, Washington, DC (USA). Transportation Research Board). 1987. 36p. (TRB-TRR—1130). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 88-4784.

The five papers in the report deal with the following areas: parking cost and mode choices among downtown workers: a case study; duration of carpool and vanpool usage by clients of rides; a ride-sharing market analysis survey of commuter attitudes and behavior at a major suburban employment center; alternative access modes data-base project; formulating ride-sharing goals for transportation and air-quality plans: Southern California as a case study.

48908 **(PB—88-221080/XAB) Radiated interference in rapid, ransit systems. Volume 1: theory and data. Final report, January 1980-December 19987.** Holmstrom, F.R.; Edelson, C. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Apr 1988. 104p. (DOT-TSC-UMTA—88-1). NTIS, PC A06/MF A01.

See also PB—87-216610.

The report presents a summary of the theory of generation and observation of radiated electromagnetic interference (EMI) in rail transit systems. The theory underlies the Suggested Test Procedures for radiated EMI in rail transit systems that were developed under the project and presented in a companion report. The report also presents representative radiated EMI data obtained from three different types of rail-transit vehicles at two locations. The data are presented as an example of results obtained from application of the Radiated Suggested Procedures.

48909 **(SAND—88-0021C) Aerodynamic design considerations for a free-flying ducted propeller.** Weir, R.J. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1988. Contract AC04-76DP00789. 32p. (CONF-880836—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006867/JAW.

From AIAA atmospheric flight mechanics conference; Minneapolis, MN, USA (15 Aug 1988).

The design philosophy for a free-flying vehicle powered by a ducted propeller is presented from an aerodynamic viewpoint. Airframe design concentrates on duct inlet lip curvature, diffuser angle, and methods of vehicle control. Wind tunnel test results are given to evaluate two inlet designs, two exit designs, and the effect of external appendages such as a camera pod or a forebody. Finally, a simple, analytic method of ducted propeller blade design is presented and the results compared with an existing ducted propeller blade. 14 refs., 28 figs., 2 tabs.

48910 **(SAND—88-0214C) Aerodynamic design of a variable-bend vehicle.** Polansky, G.F.; Rutledge, W.H. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 10p. (CONF-880836—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013004/JAW.

From AIAA atmospheric flight mechanics conference; Minneapolis, MN, USA (15 Aug 1988).

Variable-bend maneuvering vehicles provide a unique type of control for a variety of supersonic and hypersonic missions. Unfortunately, the large hinge moments often associated with these vehicles have prevented their application. A procedure is presented for the efficient design of a variable-bend geometry vehicle given a set of system constraints. In particular, the selection of vehicle parameters to produce minimum hinge moments for trimmed flight is examined in detail. 20 refs., 19 figs., 1 tab.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 48080, 48358, 48359, 48407, 49648

48911 **(AFME—85-1043) Energy component in developing countries agriculture.** Filimon, T. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1985. 44p. (In French). NTIS (US Sales Only), PC A03/MF A01; GPO Dep. Order Number DE88754624/JAW.

A quantitative evaluation of the energy resources in the world, in the developing countries and in Africa is presented. These resources are differenciated between the commercialized natural resources which distribution is organized (liquid, solid, gaseous fuels, hydroelectricity) and the non commercialized natural resources (fire-wood and agricultural wastes). Production and consumption are analysed. Energy conservation and rational use are considered.

48912 (CONF-8403264—Exc., pp 1.9.1-1.9.21) **Mixed utilization of waste heat.** Laistner, H. 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

The article is a general survey of the utilization of waste heat from industrial production, especially in the surroundings of production places, from the viewpoints of ecomony, reduction of environmental pollution, and optimal utilization of the primary energy being used. Approaches made to same energy in two communities in Southern Germany are shown as examples (Suessen, Heidenheim) to illustrate the basic thought of the article. (PJH).

48913 **(CONF-8711169—) Proceedings of the DOE/Industry Advanced Research and Development Sensor Working Group meeting, Phoenix, Arizona.** Emerson, D.B. (Energetics, Inc., Columbia, MD (USA)). 13 Nov 1987. Contract AC05-85CE40741. 350p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE88007713/JAW.

From DOE/industry advanced research and development sensor working group meeting; Phoenix, AZ, USA (13 Nov 1987).

This document includes the minutes and presentation aids of this meeting and covers: In-Situ Combustion Control; Consistency Meter; Lignin Mass Spectrometer; NBS Consistency Meter and JPL Lignin Mass Spectrometer Testing; On-Machine Sensors to Measure Paper Mechanical Properties; Modelling, Optimization and Control of Complex Physical Systems; Real Time, Non-Contract

Optical Surface Motion Monitor; and DOE/Industry Sensor Working Group Caucus Report.

48914 **(CSA—8403) Development of performance and testing standards and labelling program for electric motors. Final report.** (Canadian Standards Association). Mar 1984. 147p. (CE—01748). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Under a Canadian program to develop an electric motor energy efficiency labelling program and certification and testing procedures, a study was undertaken to develop a label for those wishing to label electric motors in accordance with a voluntary labelling program, to develop a standard for testing the energy efficiency of motors, and to evaluate the implementation of the labelling program and test standards. An initial review of existing standards showed at least 3 standards existed, all of which were deemed to give significantly different results. The American NEMA efficiency test method was the most frequently used in Canada and seemed to be the most realistic of those reviewed, so it was determined that any Canadian test method should follow this standard as closely as possible. The only area of disagreement was in the variability of stray load losses; the new Canadian Standards Association (CSA) standard deals with this aspect and the resulting test method is both accurate and repeatable. The CSA and NEMA standards were evaluated by testing an identical machine according to both standards. This testing showed the CSA standard could be used easily and was also clear, precise and free from confusion, enabling manufacturers to quote energy efficiency for electric motors according to a recognized standard and which therefore provides a base for developing a labelling program for motors. 4 refs., 24 figs., 16 tabs.

48915 **(DOE/CE—0038) The industrial sector technology use model: Project summary.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Dec 1982. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015213/JAW.

A two-year cooperative project between private industry and government to develop a credible tool for analyzing and understanding the impacts of public policy and business decisions on industrial energy use has just been completed. The resulting analytical model, a computer program called the Industrial Sector Technology Use Model (ISTUM), is expected to be broadly useful to public policy analysis, and for business planning by equipment manufacturers, energy suppliers and trade associations. The basic premise in ISTUM is that technology choices are made to minimize the total cost of production. In order to develop the capability of simulating these choices, extensive and detailed data concerning industrial sector production technologies, capabilities, and energy requirements were collected. A highly disaggregated representation of both industry specific processes and generally applicable energy services.

48916 **(DOE/CE/40637—T3) Kraft black liquor combustion: Advancement in fundamental understanding.** Clay, D.T. (Institute of Paper Chemistry, Appleton, WI (USA)). Oct 1987. Contract AC02-83CE40637. 6p. (IPC—3473-6). NTIS, PC A02. Order Number DE88015981/JAW.

Self-generated fuel streams plus purchased fossil fuel and power supply the pulp and paper industry with its energy requirements. The total industry energy use for 1986 was approximately 2.3 Quad (2300 trillion Btus). Self-generated and residue fuels accounted for 57% of the energy requirements. Spent pulping liquors provide the single largest self-generated energy source, approximately one Quad (900 trillion Btus). The pulp and paper industry also leads the nation in cogeneration performance. In 1986 eighty-nine percent (89%) of the 46 billion KWHs generated were produced by cogeneration. Spent pulping liquors supply the single largest fuel source (35%) to these cogeneration facilities. Spent pulping liquors consist of solubilized wood organics, spent inorganic chemicals, and water. Since kraft pulp dominates the North American market, 74%, kraft black liquor is the dominant spent pulping liquor. Effective recovery of high level energy and chemicals from black liquor contributes heavily toward dominance of kraft pulping. The kraft chemical recovery cycle centers around the recovery boiler. Kraft recovery boilers have been commercially available for over 50 years. The potential still exists, however, for significant improvements in energy recovery and black liquor throughput. Potential energy benefits from black liquor combustion research amount to 30 trillion Btus. Energy recovery increases often are an additional benefit from modifications made to increase black liquor throughput. Capacity increases of at least 5% are often achievable. Increased energy productivity of the kraft chemical recovery boiler will come by incorporation of improved fundamental knowledge into the technology used for boiler upgrades and new boiler construction. 5 refs., 9 figs.

48917 **(DOE/CS/40192—T2) Engineering feasibility study of remanufacture of chain saws.** Lund, R.T.; Skeels, F.D.; Heaton, G.R. Jr.; Grand, R.; Beardsley, D.L.; Gonzalez, T.A. (Massachusetts Inst. of Tech., Cambridge (USA). Center for Policy Alternatives). Aug 1982. Contract AT01-79CS40192. 281p. (CPA—82-12). NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE88015218/JAW.

This is the fourth in a series of studies on the subject of manufacturing, conducted by the Center for Policy Alternatives of the Massachusetts Institute of Technology and sponsored by the Alternative Materials Utilization Branch of the Office of Industrial Programs, US Department of Energy. These pioneering studies have served to examine the nature and extent of remanufacturing in the US, the energy and materials conservation potential of this activity, and opportunities for further development of commercially viable remanufacturing enterprises. In this volume we present a preliminary engineering feasibility study of the remanufacture of chain saws, one of the products that had been identified in an earlier study as offering an attractive opportunity for an extension of the remanufacturing concept.

48918 **(DOE/ID—10148) Evaluation of energy efficient distiller/concentrator recovery systems.** Williamson, W.R.; Williamson, R.C. (EG and G Idaho, Inc., Idaho Falls (USA); Licon, Inc., Pensacola, FL (USA)). 15 Sep 1986. Contract AC07-76ID01570. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015216/JAW.

A double effect steam fired distiller/concentrator installed at Automatic Electroplating in Newark, NJ is currently being used to process rinse water from an acid zinc plating operation. LICON approached the Department of Energy in late 1985 about monitoring the installation to make cost comparisons of a steam fired system versus the heat pump evaporators developed under DOE contracts DE-AC07-79CS40290 (Reference 1) and DE-AC07-83CE40629, henceforth referred to as 290 and 629 respectively. As a result of this solicitation, LICON received a purchase order form EG & G Idaho No. C85-100803 to monitor the installation and prepare an informal report of the findings. Except for a few acid zinc installations using energy intensive 20–90 GPH single effect evaporators constructed of borosilicate glass for acid zinc, the only technology available to meet environmental discharge regulations was conventional waste treatment with sludge disposal. These waste treatment systems, due to the rapidly escalating costs of sludge disposal, are causing economic stress in the electroplating industry. This report deals with the economic and thermal efficiency of LICON double effect steam fired climbing film evaporator and compares it to the operation of heat pump and other types of evaporators and to conventional waste treatment systems.

48919 **(GRI—88/0021) Competitive position of natural gas: Industrial solids drying: Topical report.** Minsker, B.S.; Salama, S.Y.; Olsen, K.G. (Gas Research Inst., Chicago, IL (USA); Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Jan 1988. 228p. NTIS, PC A11/MF A01. Order Number TI88015457/JAW.

Product coatings sold to original equipment manufacturers (OEM) amounted to 281 million gallons in 1985. Of this amount, about 185 million gallons were sued for painting or coating metal substrates. Most, if not all, of the OEMs use energy intensive drying processes, with the total energy consumption for paint drying of metallic substrates estimated at 92 trillion BTU in 1985. Most of the drying is done in convection ovens, and natural gas is the preferred fuel because of its relative cost, cleanliness of combus-

tion products and controllability for steady heat flux. In convection ovens, there are no fuel substitutes for natural gas in paint drying applications. However, radiation curing technologies powered by electricity can be substituted for gas-fired convection ovens in a variety of applications. The competitiveness of natural gas-fired convection ovens in relation to electric radiation curing technology is sensitive to a variety of product-related and plant-related factors. Complexity of shape, for example, is very important as radiation curing requires line-of-sight exposure of the surface to be cured. Thus, complex shapes such as automobiles cannot be easily cured by radiation, while simple shapes such as coils and containers are easily adapted to radiation curing. If a product can be cured by infrared radiation, energy use is typically reduced by about 70 percent. However, electricity costs are over three times that of natural gas on a Btu basis, and total energy costs may not be reduced or may even increase with radiation curing. At current energy prices, natural gas is still the primary choice for drying of paints and coatings in most applications. In the future, factors other than energy costs will become more important. 40 refs., 10 figs., 30 tabs.

48920 **(NP—8770312) Heat pumps for agricultural waste heat utilization. Final report.** Schulz, H.; Kroll, H.P.; Pfenning, R.; Meuren, K.; Vogt, S. (Bayerisches Staatsministerium fuer Ernaehrung, Landwirtschaft und Forsten, Muenchen (Germany, F.R.). Referat Landmaschinenwesen und Energiewirtschaft; Bayerische Landesanstalt fuer Landtechnik, Freising (Germany, F.R.)). Mar 1985. 126p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770312/JAW.

Efforts going into the development, testing and optimization of static plastic absorbers for animal shelter uses are focusing on new ways of waste heat utilization, i.e. the situation of agricultural energy consumption in the Federal Republic of Germany, energy potentials, energy conservation by means of heat pumps, the present state of the art, the state of agricultural heat pump uses. Moreover, the study informs about the testing of heat pump systems in Bavaria and discusses the experiences gained in the operation of an air-source animal shelter heat pump tested on a bull fattening farm, and different diesel heat pumps. Practical instructions for building heat pump systems (for biomass process heat recovery and space heating) are followed by an account of plastic absorber tests in a milch cow shelter. A piece of practical advice refers to the sizing and connection of heat pumps. (HWJ).

48921 **(NP—8770314) Reducing NO/sub x/ emissions from process burners in the chemical and petroleum processing industry. Final report.** Schaaf, R.; Kessler, C. (Kinetics Technology International G.m.b.H., Hamburg (Germany, F.R.)). Oct 1987. 219p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770314/JAW.

Measurements of NO/sub x/ emissions from process burners showed that most plants have higher emission levels than the orientation values set by the Conference of Environmental Ministers in April 1984. Nine different burners were tested under realistic conditions in a test furnace: Values of 100 mg/m/sup 3/ (gas burners) and 400 mg/m/sup 3/ (oil burners) were obtained with suitable operating parameters. Further studies were carried out on two selected burners, in which constructional measures resulted in a 20 to 30% NO/sub x/ reduction. Performance improvements and emission reduction were made possible in gas furnaces by a new type of burner, i.e. a radiative burner of a ceramic fibre material.

48922 **(PB—88-215819/XAB) Potential and policy issues of industrial cogeneration in the Dominican Republic.** (Hagler, Bailly and Co., Washington, DC (USA)). Apr 1987. 116p. NTIS, PC A06/MF A01.

A partial solution to the problems created by the high cost of imported energy affecting the economic well-being of the Dominican Republic is outlined. The introduction of cogeneration into the industrial sector could save a significant amount of imported fuel. COENER, a domestic government program, provides for private-sector cogeneration which, if implemented, could provide as much as 10% of the country's installed electrical-generating capacity. Results of an Agency for International Development study, reported here, indicate that the industries most likely to benefit from the cogeneration scheme and the institutional and regulatory barriers that must be overcome if a cogeneration program is to be successful.

48923 **(PB—88-866447/XAB) Waste processing and pollution in the chemical and petrochemical industries. March 1983-June 1988 (Citations from the NTIS data base). Report for March 1983-June 1988.** (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 159p. NTIS PC N01/MF N01.

Supersedes PB—86-852381.

This bibliography contains citations concerning techniques and equipment utilized for pollution control in the chemical and petrochemical industries. Topics include emissions investigations, recycling and materials recovery studies, and standards for specific industries. Sources, site-hazard evaluations, and the toxicity of specific chemicals are also discussed. (This updated bibliography contains 245 citations, 15 of which are new entries to the previous edition.)

48924 **Functional relationship-based alarm processing.** Corsberg, D.R. (to Dept. of Energy, Washington, DC). US Patent 4,749,985. 7 Jun 1988. Filed date 13 Apr 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

In the monitoring of a process, a method for classifying process alarms A and B each representing a respective operating state of the process as of primary importance or of secondary importance based upon functional relationships among the alarms is described comprising the steps of: defining each of the alarms A and B in terms of one of the following relationship categories: alarm A is a level precursor of alarm B such that alarm A should occur before alarm B; alarm A is a direct precursor of alarm B such that alarm A should occur before alarm B and alarm A's occurrence can cause alarm B's occurrence; alarm A is a priority required action of alarm B such that occurrence of alarm B should cause the activation of alarm A; or alarm A is a blocking condition for alarm B such that, with both alarms A and B activated, alarm B will not be processed until alarm A is no longer activated, or clears; and assigning primary importance to an activated alarm and secondary importance to that alarm which is not activated when one of the alarms is activated and the other alarm is not activated.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 48440, 48685, 48689, 48691, 48737, 48739, 48740, 48747, 48768, 48784, 49308

48925 **(BNL—52156) District heating technology characterization case study: Milwaukee, Wisconsin: Final report.** Coughlan, R.T.; Andrews, J.W.; Metz, P.D. (Brookhaven National Lab., Upton, NY (USA)). Mar 1988. Contract AC02-76CH00016. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88014690/JAW.

This report describes the work performed under Part II of the project entitled "District Heating and Cooling Market Potential and Penetration Study," whose purpose is to examine the potential of conventional and innovative district heating and cooling (DHC) space conditioning systems in different regions of the country. Part II, "Implementation and Application of the Conceptual Approach," employs the DHC characterization methodology previously developed in Part I of the project to compare the economic feasibility of selected DHC system types in a specific community. The city of Milwaukee, Wisconsin, was chosen as the candidate host community to study several district heating technologies. In all, six district heating system types were selected along with one baseline system. 12 refs., 25 figs., 11 tabs.

48926 (CONF-8403264—Exc., pp 1.2.1-1.2.15) **Exemplary cogeneration concept in a medium-sized town - the example of Rottweil.** Rettich, S. 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

Plans for a new residential area in Rottweil with a thermal peak load of 5050 kW and a yearly heat need of 9,09 million kWh caused the expansion of an existing cogeneration plant. A thermal power plant was constructed which, after the expansion, consists of 5 old and 6 new cogeneration units, two gas heat pumps, 3 peak boiler units and one flue gas heat exchanger of altogether 1,920 kW electric and 14,773 kW thermal power. The energy utilization is stated to be 99%. An annual saving in primary energy of 23,323 MWh against traditional power generation in condensation power plants and heat generation in thermal power plants is anticipated. (PJH).

48927 (EPRI-EM—5732, pp 6.1-6.10) **Customer acceptance of cool storage.** Rodgers, R.N. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

Cool storage air-conditioning systems are being looked at by many utilities as an effective vehicle for shifting summer peak loads to off-peak periods. Cool storage systems use traditional refrigeration or air-conditioning equipment which runs at night or off-peak to make ice or cold water. This is stored in large tanks. These tanks of cooling energy are then used later to meet building cooling loads. With our air-conditioning driven summer peaks, Florida Power & Light is looking at cool storage with great interest and we are currently considering a number of marketing alternatives to encourage customers to adopt cool storage. A key factor in the marketing of cool storage, as with any product, is that of customer acceptance. Strategies for marketing a product must have focus on what the customers' needs and wants are related to that product. This holds true with cool storage as well. The technology exists and is proven and research will continue to improve it. There are clear benefits to utilities in improved load shapes. But it is the Customer Acceptance of cool storage that is critical. Customers must accept it on a wide scale as a reliable and cost-effective option for air conditioning for any significant levels of adoption of Cool Storage to occur in the near to intermediate future.

48928 (EPRI-EM—5732, pp 7.1-7.8) **The role of incentives in commercial end-use data collection.** Hoffman, M.G.; Hughes, J.P. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

This paper covers the results of a pretest of incentives for commercial end-use data collection for Niagara Mohawk Power Corporation's (NMPC) Commercial Class Energy Management & Conservation Analysis Pilot Study as part of the Conservation Assessment Plan. XENERGY provided technical support and processing for a geographically limited pretest of a pilot market test for a commercial conservation program designed to also collect end-use data. The program to be tested was named EnergyMiser Bill Analysis and can be described briefly as follows. Customers were to be solicited by mail to complete an information survey describing their facility's energy usage characteristics and the extent of conservation measures at their facility. After returning the survey form to NMPC, a customized energy analysis report would be returned to the customer. A computer software program developed by XENERGY would produce an end-use and conservation analysis by combining billing data supplied by Niagara Mohawk with the customer-provided data. A report can be generated by computer and mailed to the customer. 1 fig., 3 tabs.

48929 (EPRI-EM—5955) **Field performance of residential load controllers: Final report.** Adamczyk, T.J.; Knowles, H.E. (Electric Power Research Inst., Palo Alto, CA (USA); BRI Systems, Inc., Phoenix, AZ (USA); Edge Engineering Group, Phoenix, AZ (USA)). Aug 1988. 273p. Research Reports Center, Box 50490, Palo Alto, CA 94303.. Order Number TI88015478/JAW.

This report presents the findings of a project that was conducted to better understand residential controller performance in two emerging technologies offering promise to improve load shape yields: local and distributed controls. It places emphasis on utility and customer impacts derived from using control devices employing seven different operating strategies: load factor managing; demand-regulating; demand-clipping; interlocking; set-point moving; duty-cycle limiting; and scheduling. Controller performance was investigated with data that was graciously provided by participating 'host' utilities. Impacts evaluated included average individual noncoincident demand, load factor, energy use and contributions to system peak demand reductions. Information was also developed on control device capabilities, algorithms, limitations, costs and reliability experienced in the field along with reviewing their acceptance by residential consumers. The identified impacts are presented for each control strategy and compared to one another. Recommendations are then offered for each control strategy outlining factors that should be given consideration in utilizing the devices to meet load-shedding and load-shaping objectives.

48930 (HQ—8705) **Hydro-Quebec. Annual report, 1986.** (Hydro-Quebec, Montreal (Canada)). May 1987. 69p. (MICROLOG—88-03031). Hydro Quebec, 75 boul. Dorchester ouest, Montreal, P.Q., Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report summarizes the activities of Hydro-Quebec in the fields of market evaluation, electric generating, transmission and distribution facilities, technical developments, electric power exports, international technological cooperation, personnel, planning, and finance. Production consumption, financial and other statistics are presented where applicable. Some future projections are given. 23 figs., 18 tabs.

48931 (MEM/CRE—MG-12258) **Solar haeted swimming pool, Vassar, Manitoba.** (Manitoba Dept. of Energy and Mines, Winnipeg (Canada). Conservation and Renewable Energy Branch; Appin Solar Associates, Inc., Winnipeg, Manitoba (Canada)). 1983. 21p. (CE—01742). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

An outdoor swimming pool exposed to the sun will absorb most of the solar radiation it encounters, and will gradually tend toward a temperature near ambient. Supplementaty heating is required to raise the water temperature to a preferred level for comfortable swimming, and to reach that level in a reasonable period of time. At Vassar the preferred pool temperature is approximately 25/sup 0/C, and supplementary heat has been required to maintain that temperature during the summer. Until 1982 the supplementary heat was supplied by a propane-fire boiler. Later that year a solar heating system was installed with assistance by the federal and provincial governments. In 1983, the first full season of operation, the performance of the solar heating system was monitored. This report indicated that the solar equipment maintained satisfactory pool temperatures during most of the summer and the insulated pool cover significantly reduced overnight heat loss from the pool. Based on the performance of the equipment, it was estimated that the pool cover has a simple pay-back period of 1.5 years, whereas the pay-back for the solar collectors is over 13 years. The simple pay-back period on the capital installation as a whole was estimated to be 6.3 years. 6 figs.

3209 Education And Public Relations

48932 (EPRI-EM—5732, pp 4.1-4.28) **Customer acceptance of commercial audit programs.** George, S.S. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88009224/JAW. (CONF-8504334—; CONF-8511330—).

From Seminar on the marketing perspective of demand-side management; Scottsdale, AZ, USA (10 Apr 1985).

From the turmoil of the last decade and a half, electric utility companies have learned the importance of a flexible and diverse management strategy that will help them succeed in an increasingly competitive and uncertain market. As part of this strategy, utilities have focused increased attention on demand-side programs designed to improve customer service, modify the rate of growth of demand and energy use, and increase load factor. Direct load con-

trol, time-of-use and interruptible rates, rebates for efficient air conditioning, and economic development programs are among the methods currently in use by electric utilities for improving company performance. One of the most widely used commercial sector demand-side management (DSM) programs is audits. The purpose of this paper is to provide an overview of the audit programs currently employed by utilities around the country, and to offer some guidance to utility program planners regarding the factors affecting customer acceptance of utility-sponsored audit programs. We also investigate the impact of audits on customer actions, since it is only through the implementation of these actions that a utility's load shape objectives can be achieved. 14 refs., 2 figs., 8 tabs.

48933 (HMC—8403) Heat pump owners attitudinal survey. Final report. Hickling, J.F. (Hickling (James F.) Management Consultants Ltd., Ottawa, Ontario (Canada)). Mar 1984. 50p. (CE—01755). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study assesses the attitudes of Canadian homeowners towards heat pumps as an alternative to conventional heating systems. A pilot survey of heat pump users and prospective users was carried out in four major urban areas and drew upon a non-random sample of households using heat pumps and households without heat pumps. The pilot survey was thus used to develop a database on consumer heating practices, awareness and knowledge of heat pumps, conservation intentions, and other information related to consumer decision-making with respect to heating system modifications. This report presents and analyzes the results of the pilot survey, with the objectives of providing a statistical profile of heat pump users and homeowners without heat pumps, and of identifying their attitudes and decision-making parameters with respect to heating system modifications. The report is structured to present the general survey response, a comparative analysis of households with and without heat pumps, an assessment of regional differences, and statistical distributions on heat pump use and performance. Results show, among other things, that heat pumps were owned by 38% of respondents, that those heat pumps in service were working well and inexpensive to maintain, and that 94% of heat pump owners indicated a decrease in their heating costs. 15 figs., 17 tabs.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 48142, 48949

48934 (AD-A—193055/1/XAB) Effects of ceramic surfaces on autoignition in a constant-volume combustion apparatus. Interim report, October 1984-December 1987. Ryan, T.W.; Kanakia, M.D.; Kohl, K.B. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Dec 1987. 25p. (BFLRF—246). NTIS, PC A03/MF A01.

A constant-volume combustion apparatus was used to determine the effects of ceramic-coated surfaces on the ignition of fuel sprays from a diesel-injection nozzle. The goal was to determine if the ceramic surfaces could enhance ignition through catalytic effects on the surfaces. Statistical analysis of the data indicated that an aluminosilicate coating had no effect, while a partially stabilized zirconia increased the delay times. It appears, however, that the aluminosilicate coating could actually enhance the ignition, producing shorter ignition delay times, if the results of the appropriate baselines are considered.

48935 (AD-A—193153/4/XAB) 210-Hp diesel engine endurance and performance testing with fire-resistant diesel fuel. Final technical report, 11 August 1986-29 July 1987. Mekari, M.H. (Army Tank-Automotive Command, Warren, MI (USA)). Oct 1987. 261p. (TACOM-TR—13322). NTIS, PC A12/MF A01.

The test program and report were conducted and prepared by the U.S. Army Tank-Automotive Command Propulsion Systems Division and laboratory. The report details performance and durability tests using Fire Resistant Diesel Fuel (FRDF). The objective of the FRDF program is to develop a future fuel that will reduce the vulnerability of military vehicles to fire, decrease the number of vehicles lost and repair costs, and increase crew survivability. The objective of this project is to evaluate the performance and endurance of a medium-sized, unmodified commercial production diesel engine of 200-hp range tested with FRDF. The FRDF contains tap water of 10.2 to 13.2% volume. Another objective of this project is to inspect the fuel-wetted parts of the fuel-injection system and engine, and determine the effect of the water in the fuel on these parts.

48936 (AD-A—193213/6/XAB) Analytical and experimental investigation of ringless-piston concept. Final report, September 1986-November 1987. Dickey, D.W.; Wood, C.D. (Southwest Research Inst., San Antonio, TX (USA)). Mar 1988. 56p. (SWRI—1362). NTIS, PC A04/MF A01.

Also available as BFLRF-247.

The purpose of this project was to analytically and experimentally investigate the concept of a ringless-piston internal combustion engine. A joint objective was to design, build, and test a ringless piston to improve ringless piston engine performance. A computer model was developed to predict ringed and ringless piston engine performance. Experimental performance data were then collected by operating a small, liquid-cooled, two-stroke gasoline engine with and without the piston ring on the stock aluminum and Southwest Research Institute prototype steel piston. The experimental performance data were then compared with the results of the computer model. The results showed that a piston engine can operate without piston rings. Ringless-piston engine power and efficiency were found to be defined by the expression C/NBS, where C = piston-to-bore diametrical clearance, N = engine speed in rpm, B = engine bore, and S = engine stroke. There was good agreement between predicted and measured performance reperformance can be improved by using piston and liner materials that have similar coefficients of thermal expansion.

48937 (AD-A—193360/5/XAB) Basic mechanisms of diesel lubrication: correlation of bench and engine tests. Annual report No. 1. Alliston-Greiner, A.F.; Greenwood, J.A. (Cambridge Univ. (UK)). Aug 1987. 80p. NTIS, PC A05/MF A01.

Errata sheet inserted.

A newly designed reciprocating ball-on-flat apparatus is described. Reaction film formation by commercially available ZDDP additives were observed and their thicknesses measured by capacitance during the rubbing process. The film behavior is related to its composition and the thermal stability and reactivity of the additives. Preliminary observation is made of the running-in process with cast-iron cylinder liners. The program of work proposed for the coming year is detailed in the Appendix.

48938 (AD-A—193787/9/XAB) Modeling of spray combustion in Direct-injection diesel engine. Final report, January 1984-December 1987. Singh, H.; Klett, D.E. (North Carolina Agricultural and Technical State Univ., Greensboro (USA)). 30 Jan 1988. 103p. NTIS, PC A06/MF A01.

A mathematical model was developed to predict the penetration of a transient fuel spray, the temporal and spatial distribution of air-fuel mixture before the end of ignition delay and the subsequent pressure rise during combustion in a Direct-Injection Diesel Engine with and without swirl. The model accounts for the non-isothermal and non-isobaric character of processes during fuel injection resulting from continuous motion of the piston. The effects of various engine operating variables on spray were studied and graphically presented. The calculated spray penetration with and without crossflow of air is compared with the available experimental data of other researchers with good agreement. The model can predict the rate of combustible-mixture formation, the rate of heat release and cylinder pressure as a function of time in direct injection (DI) diesel engine. A single-cylinder D.I. research diesel engine was operated with N-hexadecane as the engine fuel to validate the mathematical model. However, a leaking head gasket rendered the data unusable, so comparisons between modeled and measured cylinder pressure-rise data are not included in the report.

48939 (DOE/CE/40762—T1) Summary of R and D program to develop coal/water slurry diesel engine: Final report. (RCG/Hagler, Bailly, Inc., Washington, DC (USA)). 8 Jun 1988. Contract AC01-87CE40762. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013253/JAW.

The overall goal of this R&D program was to provide information that would assist industry in commercializing an energy efficient diesel engine capable of operating on coal-based fuels. DOE focused on proving the feasibility of the concept of coal/water slurry combustion in diesel engines. A slow-speed, two-stroke laboratory unit was used for data acquisition. This included demonstrating that economic conversion efficiencies could be achieved at acceptable power outputs, identifying engine and fuel related problems to be overcome before commercialization, and determining the range of fuel characteristics and specifications that would be technically and economically acceptable. A review of the results obtained by DOE indicates that the CWS-fired diesel engine R&D program was a significant technical success overall. The most important results demonstrated in these tests were: Slow-speed diesel engines can operate on CWS fuels. A total of nearly 50 hours of engine running time was accumulated on the single-cylinder test engine using four selected CWS fuels at a variety of engine loads ranging from 25 percent to 90 percent. Moreover, the hypothesis that engine parameters optimized for one slurry are valid for the other slurries was confirmed. Thermal efficiencies of CWS fuels are comparable to those obtained using No. 2 fuel oil. Emissions are lower when the engine burns CWS than when it burns No. 2 fuel oil. The engine operates more smoothly when burning CWS fuels than when burning No. 2 fuel oil. Economic power conversion efficiencies are obtained when using a CWS containing approximately 50 percent coal. 20 refs.

48940 (ORNL/Sub—85-22008/1) Development of ceramic matrix composites for application in the ceramic technology for advanced heat engines: Final report. Yeh, H.C.; Schienle, J.; Karasek, K.; Bradley, S. (Oak Ridge National Lab., TN (USA); Garrett Corp., Torrance, CA (USA). Ceramic Components Div.). Jun 1988. Contract AC05-84OR21400. 177p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88015329/JAW.

A technology base for fabrication of SiC whisker-reinforced Si_3N_4 composites was developed. The feasibility of fabricating near-netshape SiC-Si_3N_4 using procedures amenable to production was demonstrated. Green composite parts containing up to 40 percent SiC whiskers were prepared by slip casting and were densified to greater than 3.2 gm/cc using both metal and glass encapsulation HIP processing. Improvements in both strength and fracture toughness were achieved in Si_3N_4 through SiC whisker reinforcement. The strength, toughness, and elastic and thermal properties were correlated with whisker chemistry, whisker loading, processing parameters, and microstructure. 20 refs, 75 figs, 22 tabs.

48941 (ORNL/Sub—85-27416/1) Time-dependent mechanical behavior of partially stabilized zirconia for diesel engine applications: Final report. Ferber, M.K.; Hine, T. (Oak Ridge National Lab., TN (USA); Illinois Univ., Urbana (USA). Dept. of Ceramic Engineering). Jul 1988. Contract AC05-84OR21400. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015330/JAW.

Recently there has been considerable interest in utilizing ceramic materials in diesel engine applications. And as a result of this interest, the fatigue behavior of several commercially-available MgO partially stabilized zirconias (Mg-PSZ) was studied by measuring the strength (S/sub f/ as a function of time (t), temperature (T), and applied stress level (σ). The two Mg-PSZ types included TS PSZ (thermal shock grade) and MS PSZ (maximum strength grade/1983 vintage). Both 1983 and 1984 vintages of the TS PSZ (designated TS(83) and TS(84)) were examined. The strength was determined using an interrupted fatigue (I.F.) test in which flexure samples were exposed at temperatures between 500 and 1000{degree}C for times up to 1000 h. During testing, the applied stress was maintained at a percentage of the short-term S/sub f/ value measured at the same T. Specific stress levels included 0, 60, 70, and 80%. The following techniques were used to characterize both the as-received and tested I.F. specimens: (1) SEM, (2) TEM, (3) optical microscopy, (4) x-ray diffraction, (5) micro-Raman spectroscopy, and (6) dilatometry. SEM allowed for routine examination of the microstructures and fracture surfaces. Changes in the primary phase assemblage resulting from the high-temperature exposure were monitored using x-ray diffraction, Raman spectroscopy, and standard optical phase analysis. The hysteresis characteristics which were determined from dilational measurements provided insights into the nature of the tetragonal (t) to monoclinic (m) transformation and thus the stability of the (t) precipitates. Finally, TEM was used to study the influence of stress, time, and temperature upon the microstructure of the I.F. samples. 26 refs., 23 figs., 4 tabs.

48942 (PB—88-206123/XAB) Effect of fuel properties on diesel-engine combustion. Part 1. Myburgh, I.S. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Mechanical Engineering Research Inst.). 1986. 14p. (CSIR-ME—510). NTIS, PC E04/MF E04.

North American Continent sales only.

The paper describes initial tests undertaken to develop and evaluate various measuring techniques that could eventually be used to determine the influence of fuel properties, such as, inter alia, ignition quality, volatility and chemical structure on the combustion process in a diesel engine. A better understanding of the effect of these fuel properties on the compression-ignition process will enable recommendations to be made to the oil companies regarding the formulation of new diesel-engine fuels. Certainly, South Africa is now in a unique position to be able to produce the ideal diesel fuel. The investigation may also contribute towards redefining a more meaningful index of ignition quality - one that is more relevant to the modern high speed diesel engine. For these initial tests a computerized testing procedure was developed to analyze the various combustion parameters of a running engine using a range of fuels which could be marketed by the fuel producers in the short term.

48943 (PB—88-206172/XAB) Phenomenon of high-speed knock in spark-ignition engines. Falk, R.S. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Mechanical Engineering Research Inst.). 1988. 17p. (CSIR-ME—511). NTIS, PC E04/MF E04.

North American Continent sales only.

The use of alcohols as octane improvers is increasing as the lead is removed. Associated with the use of alcohols is a knock problem, especially at high engine speeds of 3000 r/min and over. This is especially dangerous because knock may be inaudible above the other noises from the vehicle, so there is no warning of the impending danger. The aim of Octane Requirement (OR) tests is to determine whether an engine can operate free from knock. This is different from being able to operate satisfactorily without damage on a gasoline of lesser Octane Number (ON). There is no advantage to be gained from using a gasoline of ON greater than the minimum that an engine can run on satisfactorily. Octane requirement surveys are carried out in Europe, in the USA, in Japan, and in Australia. There is no similar program in the Republic at present.

48944 (PB—88-206214/XAB) Viability of propanol-plus as a diesel-fuel extender. Myburgh, I.S. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Mechanical Engineering Research Inst.). 1984. 19p. (CSIR-ME—513). NTIS, PC E04/MF E04.

North American Continent sales only.

Initial tests using propanol-plus, an alcoholic by-product of the SASOL fuel-from-coal process, indicated that in comparison with methanol and ethanol, it appeared to be more suitable as a diesel-fuel extender. Consequently, more detailed performance tests were done on a direct-injection diesel engine using a blend of 20% propanol-plus and 80% SASOL diesel. The results of these tests revealed that in comparison with normal diesel operation, power decreased by an average of 5% throughout the speed range and fuel consumption increased by an average of 5 1/2% throughout the load and speed ranges. The engine also satisfactorily completed 300 hours of a particularly severe durability cycle. However, the higher than expected wear in the fuel-injection pump requires further investigation.

48945 **(PB—88-866454/XAB) Lubrication and wear of pistons and piston rings. November 1982-June 1988 (Citations from Fluidex data base). Report for November 1982-June 1988.** (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 51p. NTIS PC N01/MF N01.

Supersedes PB—686-864329.

This bibliography contains citations concerning the lubrication and wear of pistons and piston rings. Topics include friction characteristics, service life testing, materials testing, and design of piston rings and liners for various applications. Molybdenum disulfide based lubricants are discussed. The behavior characteristics of lubricated piston rings are analyzed, and performance evaluations of various lubricants are included. (This updated bibliography contains 140 citations, 71 of which are new entries to the previous edition.)

3302 External Combustion Engines

48946 **(DOE/NASA/0032—31) Automotive Stirling Engine development program: Semiannual technical progress report, January 1--June 30, 1987.** (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Mechanical Technology, Inc., Latham, NY (USA)). Feb 1988. Contract AI01-85CE50112. 75p. (NASA-CR—180840; MTI—87-ASE-575-SA-12). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013875/JAW.

During this reporting period, progress was made toward the performance characterization of the Mod II engine, and by the end of the period, the engine hours had increased by 203 hours to a total of 223. Performance evaluation of the Mod II Basic Stirling Engine (BSE) began.

3303 Electric-powered Systems

48947 **(DOE/ID—10205) Electric vehicle auxiliary power source evaluation.** Farmer, F.G.; Hill, A.D.; Jacobsen, J.F.; Johnson, M.R. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1988. Contract AC07-76ID01570. 50p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015359/JAW.

This report focuses on the electric vehicle auxiliary power system. This involves a collection of devices needed to operate the vehicle, including headlamps, blowers, instrument panel, entertainment equipment, windshield wipers, horn, turn signals, control electronics, etc. These devices are traditionally connected to a common 12 vdc power bus. In an EV, the traction battery is the prime source of power but this battery is at the wrong voltage level and lacks the regulation required by most auxiliary devices. Hence there is a need for an auxiliary power system. All of the methods for providing auxiliary power that are presently being investigated involve the use of a dc-dc converter whose task is to convert the traction battery voltage to 12 vdc, and to regulate this voltage in the face of traction battery voltage variations. This report addresses three objectives. First, it summarizes the status of currently available dc-dc converters and regulators in terms of the needs and difficulties experienced by in-service electric vehicles. Second, it provides an engineering assessment of these devices to determine whether the technology exists to solve the in-service maintenance and reliability problems. Third, it examines the longer range needs of auxiliary power system design and development. 15 refs., 2 figs., 2 tabs.

3306 Vehicle Design Factors

48948 **(NP—8770384) TOPAS - road tanker with improved passive and active safety systems.** (Daimler-Benz A.G., Stuttgart (Germany, F.R.); Fahrzeugbau Haller G.m.b.H., Stuttgart (Germany, F.R.); Raab Karcher A.G., Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 17 Nov 1986. 20p. (In German, English and French). NTIS (US Sales Only), PC A03. Order Number DE88770384/JAW.

Three major German companies introduce a foint project for further traffic safety improvements and reduction of environmental impact: A road tanker with active and passive safety systems. Based on comprehensive preliminary research and trials with a pre-prototype, the two-axle articulated cab with air suspension on the rear axle is safety-enhanced by means of an anti-lock device, engine slip-control, differential lock, retarders, electro-pneumatic gearchange and electronic air pressure monitoring on all tyres. The 3-axle trailer with a tank capacity of 30,000 litres has active safety devices which include a low centre of gravity, wide tyre treads, anti-lock system, air suspension, a rear swing-out warning indicator and manoeuvring aid (video camera). The cab and trailer are both painted in a clearly-visible safety paint. The prototype vehicle is now undergoing urban traffic trials. (HWJ).

3307 Emission Control

REFER ALSO TO CITATION(S) 49312

48949 **(AD-A—193321/7/XAB) Signature suppression kits for the mil-std 10-kW gasoline-driven engine-generator set. Final report, 22 September 1983-30 April 1985.** Allard, E.F. (Area Therm Corp., Lorton, VA (USA)). Mar 1988. 29p. NTIS, PC A03/MF A01.

The project objectives of this report were: (1) To conduct investigations on thermal and acoustical signatures of the 10-kW, 60-HZ Model 018A Gasoline Engine Driven generator sets as mounted on the 619/M trailer; (2) To build experimental suppressors for the 10-kW E-G sets and to test these suppressors; (3) To fabricate and deliver suppressors for two trailers; (4) To fabricate and deliver kits for four additional E-G sets; (5) To provide a data package. The seemingly impossible goal of 70 dBA measured at 7 meters was achieved and was surpassed in fact. This was done without enclosing the entire set. The suppressor did not significantly increase the 10-kW operating temperatures. The kit form of the design allows for rapid access for maintenance. The design eliminates recirculation when the set is mounted on a trailer, thus helping the cooling problem. The design reduces but does not eliminate the thermal signature problem.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 48136, 48149, 48889, 48939

48950 **(CR—TP3331E) Potential propane vehicle fuel market: Ontario, Manitoba, Saskatchewan, Alberta and British Columbia, 1980-1990. Final report.** (Canadian Resourcecon Ltd., Calgary, Alberta). Feb 1981. Vp. (CE—01680). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report first summarizes information on the current location and quantities of propane production; both refinery and gas plant production are included. It then discusses the existing transportation and storage facilities which facilitate the movement of propane from the production areas, particularly Alberta, to propane distributors. Shipping rates and tariffs are included in an appendix. A brief description is presented of the propane distributors in each province; the attitudes of the propane distributors to propane carburetion are also discussed. Approximately 45 commercial fleet operators were interviewed in three cities - Vancouver, Calgary, and Toronto - in order to collect descriptive information on fleet operations and to ascertain information on fleet operators' attitudes toward propane carburetion. An economic analysis is made of propane carburetion and forecasts are done of future propane use by motor vehicles. For each province a range of forecasts are presented based on different assumptions concerning the prices of fuels and conversions incentives offered. A concluding chapter offers opinions as to the appropriate Federal government strategy vis-a-vis propane carburetion. 2 refs., 1 fig., 40 tabs.

48951 **(RFW—8202) R & D program development alcohol-based transportation fuels. A preliminary report.** (Webb (R.F.) Corp. Ltd., Ottawa, Ontario (Canada)). 22 Feb 1982. 87p. (CE—01704). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report forms part of a series of investigation of strategic planning related to transport fuels. This part deals with alcohol-based fuels, and in particular with the definition of a suite of research, development and demonstration projects. In Part I, supply, demand and cost considerations are reviewed for fuel grade methanol, ethanol, higher alcohols and their derivatives and an appreciation given of the technical, economic and market limitations which condition their widespread adoption as alteratives to conventional transport fuels. In Part II, specific research, development and demonstration projects are presented, the conduct of which may supply new information on the use of alcohols in transport, assist in the selection of the most appropriate fuel/vehicle system options for Canada and expedite their introduction. 15 figs.

35 ARMS CONTROL

48952 (AD-A—192794/6/XAB) Future SDI (Strategic Defense Initiative) decision making. Study project. Holman, B.W. (Army War Coll., Carlisle Barracks, PA (USA)). 29 Mar 1988. 36p. NTIS, PC A03/MF A01.

Nearly five years have lapsed since President Reagan made his now famous speech launching his Strategic Defense Initiative. Yet, polarized debate continues over the program's feasibility, desirability, affordability, goals, and direction. Some claim the program's goals have changed over time, and that today the primary goal is for an enhanced deterrence rather than providing a population defense as originally envisioned. Although the Congress has provided continuing and expanded funding for SDI, a consensus does not exist between the Congress and the Administration over the program's direction and goals. Some concerns exist within the Congress that the Administration is rushing too quickly to reach a decision on initial system development. Others would like to see initial development of a more limited defensive capability than that envisioned by the SDI program. This paper examines the evolution of SDI from a policy standpoint and addresses a series of questions that taken together may suggest parameters for future decision making.

3501 Policy, Negotiations, And Legislation

REFER ALSO TO CITATION(S) 49483

48953 (AD-A—192366/3/XAB) Flexible response and the INF (Intermediate-range Nuclear Force) Treaty: what next. Study project. Williams, H.A. (Army War Coll., Carlisle Barracks, PA (USA)). 14 Mar 1988. 37p. NTIS, PC A03/MF A01.

The prospect of the Intermediate-range Nuclear Force (INF) Treaty led the former Supreme Allied Commander, Europe, GEN Bernard Rogers, to claim that NATO would lose weapons vital to the Alliance's defense when Pershing II (PII) and Ground-Launched Cruise Missiles (GLCM) were withdrawn from Europe. Nuclear weapons and the NATO strategy of flexible response are inseparably dependent upon each other. GEN Rogers' comments focus directly on the capability which PII and GLCM provided NATO to strike Soviet territory in event of conflict and if such an escalatory step was deemed necessary. Various sources were researched to determine if the INF Treaty will cripple the flexible response strategy; while it should not, certain changes in NATO's approach to defense are suggested. Specifically, conventional and nuclear improvements, the latter within the terms of the INF Treaty, are suggested, as are conventional force reduction negotiations and the Europeanization of NATO.

48954 (AD-A—192744/1/XAB) Conventional arms control revisited: objectives in the new phase. Interim report. Thomson, J.A.; Gantz, N.C. (RAND Corp., Santa Monica, CA (USA)). Dec 1987. 25p. (RAND/N—2697-AF). NTIS, PC A03/MF A01.

Conventional arms control policy ought to be closely coordinated with defense policy, but the Western allies have been unable to do so. Linkage is difficult because of he institutional differences between force planners on the one hand, and arms controllers on the other. Aggravating the problem is the lack of a unifying framework by which outcomes in both areas can be assessed. The authors outline a three-step process for designing a unified concept for defense and arms control planning, describe the long-term coordination of the process, and identify principles that should guide NATO's conventional arms control planning.

48955 (AD-A—193851/3/XAB) Capabilities and application of a dedicated conventional bomber force in 1993. Student report. Thomits, J.R. (Air Command and Staff Coll., Maxwell AFB, AL (USA)). Apr 1988. 85p. (ACSC—88-2560). NTIS, PC A05/MF A01.

The removal of intermediate-range ballistic missiles as a result of the INF treaty presents conventional balance-of-force implications that will be difficult for NATO to redress in the short term. This study evaluates how a dedicated conventional B-52 force, updated with presently available or programmed technologies, could be applied to overcome the conventional-force imbalance.

48956 (AD-A—193957/8/XAB) Arms control and British and French nuclear forces. Master's thesis. Schroeder, M.J. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1987. 71p. NTIS, PC A04/MF A01.

In February 1987, the Soviets dropped their most-recent demands for compensation from the United States for British and French nuclear forces in the INF negotiations, while reserving this demand for future arms-control negotiations. This thesis provides background on the recurrent Soviet demands; it includes a historical description of the demands in the major arms control proposals in SALT I, SALT II, INF, and START. It examines French and British nuclear forces, employment doctrine, and arms-control policies. Finally, it reviews Soviet and American policies regarding these weapons and considers implications for the Atlantic Alliance.

48957 (AD-A—193972/7/XAB) Life after INF (Intermediate-range Nuclear Forces): West Germany in the year 2000. Study project. Lauter, V.A. (Air War Coll., Maxwell AFB, AL (USA)). 14 Mar 1988. 31p. NTIS, PC A03/MF A01.

West Germany should be much wealthier in 2000, with an aging populace seeking a higher quality of life, economic security and increased trade with the Warsaw Pact. The United States is expected to alter the military equilibrium of this prosperous society. Removing intermediate-range nuclear forces (INF) should trigger a chain of events that would speed up the Europeanization of Europe. Germany and France would establish a bilateral military force within NATO, and France would then forward deploy two additional divisions and nuclear weapons onto German soil. These events would present significant foreign-policy challenges to the United States. These include dealing with a more independent-minded German ally, supporting the growing military power and influence of France, and playing a less visible role in NATO. Information for this study was gathered using a review of the literature and analyzing the views of key military and civilian NATO experts.

48958 (AD-A—194054/3/XAB) Operational level of war fire-support role for the operational-level commander. Study project. Bronner, D.E. (Air War Coll., Maxwell AFB, AL (USA)). 18 Apr 1988. 59p. NTIS, PC A04/MF A01.

In recent years there has been an increasing emphasis and awareness of the conduct of warfare at the operational level. As a result, the role of the operational-level commander has been the focus of much discussion and study. One area, among many, in which the role of the operational-level commander is expanding is that of fire support. This study examines the role of this commander in the area of operational fire support, using the Commander Central Army Group as the example. The study examines the appropriateness of providing operational level commanders with an organization and a deep-strike field-artillery weapons system to facilitate attack of targets at operational depths. The study provides some background information on concerns posed by the Intermediate Range Nuclear Force Treaty, as well as a discussion of key terms concerning the operational level of war, and operational fires. It also explores the types of targets the operational-level commander is interested in attacking, the characteristics of deep-attack weapons systems, target-acquisition requirements, a proposed fire-support organization and command relationships. Finally, the study

draws some conclusions and makes recommendations concerning operational fires.

48959 **(LA—11181) United States space policy: Review and assessment.** Garrity, P.J. (Los Alamos National Lab., NM (USA)). Jun 1988. Contract W-7405-ENG-36. 40p. (CNSS—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015538/JAW.

This report summarizes two key documents that reflect official US space policy: (1) the January 1988 Presidential directive on overall US national space policy; (2) the February 1987 Department of Defense space policy. The report examines various US military, civilian, commercial, and arms control activities as they relate to space. 100 refs.

3503 Verification

48960 **(UCRL—98461) Verifying arms control treaties to deter violations.** Strait, R.S.; Judd, B.R. (Lawrence Livermore National Lab., CA (USA)). 23 Jun 1988. Contract W-7405-ENG-48. 29p. (CONF-8806178—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88014181/JAW.

From 56. Military Operations Research Society; Monterey, CA, USA (29 Jun 1988).

Verification has developed into a very important arms control issue. As evidenced by the recent Senate debates concerning ratification of the INF Treaty, verification can be a very controversial and emotional topic. In addition, verification's importance will surely continue for the foreseeable future. It is a major issue in the negotiations toward large reductions in strategic weapons and will gain even greater importance should deeper cuts be considered. 34 refs., 7 figs.

48961 **How to insure that data acquired to verify treaty compliance are trustworthy.** Simmons, G.J. (Sandia National Labs., Albuquerque, NM (US)). *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers);* 76: No. 5, 621-627(May 1988).

In a series of papers, this author has documented the evolution at the Sandia National Laboratories of a solution to the problem of how to make it possible for two mutually distrusting (and presumed deceitful) parties, the host and the monitor, to both trust a data acquisition system whose function it is to inform the monitor, and perhaps third parties, whether the host has or has not violated the terms of a treaty. They start by assuming that such a data acquisition system exists, and that the opportunities for deception which are the subject of this paper lie only in the manipulation of the data itself, i.e., forgery, modification, retransmission, etc. The national interests of the various participants, host, monitor and third parties, at first appear to be mutually exclusive and irreconcilable, however the authors will arrive at the conclusion that it is possible to simultaneously satisfy the interests of all parties. The technical device on which this resolution depends is the concatenation of two or more private authentication channels to create a system in which each participant need only trust the part of the whole which he contributed. In the resulting scheme, no part of the data need be kept secret from any participant at any time; no party, nor collusion of fewer than all of the parties can utter an undetectable forgery; no unilateral action on the part of any party cna lessen the confidence of the others as to the authenticity of the data and finally third parties, i.e., arbiters, can be logically persuaded of the authenticity of data. Thus, finally after nearly two decades of development a complete technical solution is in hand for the problem of trustworthy verification of treaty compliance.

36 MATERIALS

REFER ALSO TO CITATION(S) 48022, 49149, 49453

48962 **(IRIM—8701) Study on silicon carbide.** (National Inst. for Researches in Inorganic Materials, Tokyo (Japan)). 20 Nov 1987. 81p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88753448/JAW.

The sintering of silicon carbide representative of covalent materials and the developing mechanism of strength of its sintered material have been studied for five years from 1982 to 1986. For theoretically studying the sintering the knowledge concerning the properties of crystal at high temperature and the structure and composition of interparticle boundaries was accumulated, and the causes of many problems existing in the conventional theoretical system were investigated. The result of the study on the interparticle boundaries indicates that the interparticle energy of high-purity SiC is closely related to the geometrical consistency of bonds in the interparticle boundaries and that the general interparticle energy is so high that the densification of high-purity powders is inhibited. It is, therefore, necessary for densifying SiC and Si_3N_4 and developing the strength of them to reduce the interparticle energy by putting disordered phase bondable with the surface of SiC and Si_3N_4 between the interparticle boundaries. (93 figs, 22 tabs, 122 refs)

48963 **(IRIM—8703) Study on zinc oxide.** (National Inst. for Researches in Inorganic Materials, Tokyo (Japan)). 20 Nov 1987. 144p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88753450/JAW.

This paper outlines the study conducted under the subject for research of ZnO, from April, 1982 to March, 1987. ZnO is a typical functional ceramic similar to perovskite and it is used for semi-conductor resistor, gas sensor and surface elastic wave element. The construction of ZnO includes various higher-dimensional structure such as point defect, dislocation, unbalance, interparticle boundaries, cation distribution, laminate defect and surface structure as well as the basic structure identified by X-rays. It is difficult to understand the real substance of the ceramic due to these diversified constructions. The purpose of the study was to completely understand the higher-dimensional structure and obtain the relationship of the construction with the synthetic process and physical properties of the ceramic. This paper presents the results of the study on the theory of sintering, the sintering properties, the powder characteristics, the diffusion of ZnO and Zn-ferrite, the structure and physical properties of ZnO semiconductor resistor, and the physical properties and structure of La-added polycrystalline barium titanate. (182 figs, 42 tabs, 4 photos, 235 refs)

48964 **MiCon 86: Optimization of processing, properties, and service performance through microstructural control; Proceedings of the Symposium, Philadelphia, PA, May 15, 16, 1986.** Bramfitt, B.L.; Benn, R.C.; Brinkman, C.R.; Vander Voort, G.F. Philadelphia, PA; American Society for Testing and Materials (1988). 327p. (CONF-8605128—).

From MiCon '86: optimization of processing, properties, and service performance through microstructural control; Philadelphia, PA, USA (15 May 1986).

Various papers on high-temperature materials for power generation and aerospace are presented. Individual topics addressed include: development of microstructure to optimize mechanical performance of power generation equipment, effects of residual elements in heavy forgings, new low-chromium ferritic pressure vessel steels, microstructural stability and control for improved irradiation resistance and for high-temperature strength of austenitic stainless steels. Also considered are: role of electron microscopy in gas turbine materials development, trends in atomization and consolidation of powders for high-temperature aerospace materials, microstructure-property relationships in directionally solidified single-crystal nickel-base superalloys, development of nickel and nickel-iron aluminides for elevated-temperature structural use, microstructure and property relationships in oxide dispersion-strengthened alloys, alloy chemistry and microstructural control to meet the demands of the automotive Stirling engine, control of fiber architecture for tough net-shaped structural composites.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 48187, 48187, 48288, 48427, 48514, 48514, 48546, 48549, 48550, 48554, 48663, 48668, 48668, 49237, 49251, 49335, 49335, 50010, 50011, 50012, 50231, 50235

48965 **(AD-A—193222/7/XAB) Effect of microstructure on the fatigue crack-propagation behavior of Ni-base superalloys. Technical report, 1 May 1984-30 September 1987.** Antolovich, S.D. (Georgia Inst. of Tech., Atlanta (USA). School of Material Engineering). Dec 1987. 100p. NTIS, PC A05/MF A01.

The objective of this study was to determine the effect of microstructural properties on the fatigue crack-propagation (FCP) response of nickel-base superalloys. This report describes the results of four experimental alloys containing various amounts of Al, Ti, Cr, and Mo. Chemistry, precipitate size, and grain size were varied to produce systematically controlled microstructures. The four alloys were characterized for chemical composition, microstructure, tensile properties, low cycle fatigue (LCF), and FCP resistance. The FCP tests were performed under constant load (increasing K) conditions in air at a stress ratio (R) of 0.1 and 0.8. Closure loads were measured with a clip gage, back-face strain gage, and a laser extensometer.

48966 **(AD-A—193288/8/XAB) Effects of hafnium additions on the solidification behavior of directionally solidified superalloys. Final report, 1 June 1975-31 August 1977.** Brody, H.D.; Giamei, A.F. (Pittsburgh Univ., PA (USA). Dept. of Metallurgical and Materials Engineering). Oct 1981. 175p. (SETEC-MME—81-043). NTIS, PC A08/MF A01.

A cooperative university/industry research program into the effect of hafnium additions on the solidification behavior of nickel base superalloys was carried out under Air Force sponsorship at the University of Pittsburgh and Pratt and Whitney Aircraft Company. The research was aimed at gaining a fundamental understanding of the basic solidification characteristics, i.e., development of structure and segregation, of hafnium-modified MAR-M200 over the normal range of casting conditions and for a reasonable variation in alloy content, especially hafnium content.

48967 **(AD-A—193420/7/XAB) Constant-amplitude fatigue-life data for notched and unnotched annealed ti-6al-4v sheet. Final report, January 1983-September 1986.** Rhode, T.M.; Ertel, P.W. (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH (USA)). Jan 1988. 38p. (AFWAL-TR—88-4081). NTIS, PC A03/MF A01.

Three lots of annealed Ti-6A1-4V sheet material in thicknesses of 0.063, 0.070, and 0.078 inch, supplied by two manufacturers, were tested to develop fatigue life curves for MIL-HDBK-5. Notched (Kt=3.0) and unnotched configurations of longitudinal and transverse specimens were tested at R ratios of +0.5, +0.1, and -0.5. Fatigue-life data are presented in both tabular and graphical forms. Results are presented in both tabular and graphical forms. Results were forwarded to the Battelle Memorial Institute, Columbus, Ohio, for analysis, reduction, and inclusion in MIL-HDBK-5.

48968 **(AD-A—193619/4/XAB) Development of metastable processing paths for high-temperature alloys. Semi-annual report, 1 October-31 March 1987.** Boettinger, W.J. (National Bureau of Standards, Washington, DC (USA). Metallurgy Div.). 31 Mar 1987. 47p. NTIS, PC A03/MF A01.

The possibility of developing new processing strategies for high-temperature intermetallic compounds was investigated. In particular, rapid solidification followed by controlled heat treatment may provide new and unusual microstructures of multiphase materials. This report describes research performed at NBS to develop predictive models for solubility extension and metastable-phase formation of intermetallic compounds and research to improve the phase-diagram modeling of systems involving ordered phases. Theory was developed to treat the formation of disordered variants of intermetallic compounds during rapid solidification. Using a modification of the Aziz solute-trapping theory, solidification velocities required to form, for example a BCC phase from the melt when a B2 phase is the stable phase were developed.

48969 **(AD-A—193767/1/XAB) Advanced processing and properties of high-performance alloys. Technical report No. 9, 1 February-31 December 1987.** Koss, D.A. (Pennsylvania State Univ., University Park (USA). Dept. of Materials Science and Engineering). Mar 1988. 27p. NTIS, PC A03/MF A01.

Progress is reviewed for a research program whose purpose is to establish a broad-based understanding of the application and consequences of advanced processing techniques, especially as they influence the strength and fracture resistance of high-performance structural alloys. While some of the research is specific to certain alloy systems, much of the program constitutes a fundamental study of the deformation and fracture of engineering alloys containing processing-induced defects.

48970 **(AD-A—194123/6/XAB) Ballistic-compressor examination of electrodeposited niobium. Final report.** Jennings, L.D.; Marotta, A.S.; Pan, S.K. (Army Materials Research Agency, Watertown, MA (USA). Materials Technology Lab.). Mar 1988. 16p. (MTL-TR—88-4). NTIS, PC A03/MF A01.

As part of a program to simultaneously examine the capabilities of the MTL ballistic compressor and to characterize materials, a series of high-pressure, high-temperature shots were made on specimens of niobium electrodeposited on a copper substrate. Each shot allowed the test gas to flow through an experimental channel. The resulting surfaces were examined optically and by scanning electron microscopy, and mass loss was measured. On the basis of these, it was noted that the niobium offered a measure of protection to the underlying material, and underwent a different damage mechanism than does steel. This mechanism is elucidated.

48971 **(BNL—41469) Soft mode behavior in Ni--Al alloys.** Shapiro, S.M.; Yang, B.X.; Shirane, G.; Larese, J.Z.; Tanner, L.E.; Moss, S.C. (Brookhaven National Lab., Upton, NY (USA)). Jun 1988. Contract AC02-76CH00016. 8p. (CONF-880715—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015195/JAW.

From 4. international conference on neutron scattering (ICNS '88); Grenoble, France (12 Jul 1988).

Inelastic neutron scattering experiments performed on carefully prepared single crystals of Ni/sub x/Al/sub 1{minus}x/ (x {equals} 50, 58, 62.5 at. percent) reveal an anomaly in the {{zeta}{zeta}0}-TA mode whose position in {zeta} depends linearly on x. The temperature dependent studies of the 62.5{percent} alloy show marked softening of the phonon energy at {zeta} {equals} 1/6. At the same temperatures, an elastic central peak develops. At T{sub M} {equals} 80K a new structure develops which exhibits a modulation at nearly, but not exactly, {zeta} {equals} 1/7. 11 refs., 2 figs.

48972 **(CONF-880855—3) Engineering processing and properties of nickel aluminides.** Sikka, V.K. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88011019/JAW.

From 2. international SAMPE metals and metals processing conference; Dayton, OH, USA (2 Aug 1988).

Ordered intermetallic compounds of iron, nickel, and titanium are materials recently under development for structural applications. Among these, Ni_3Al has been made reasonably ductile by the addition of small amounts of boron. Further additions of zirconium and chromium have been utilized for enhancement of high temperature strength and intermediate temperature ductility. Nickel aluminide alloys based on Ni_3Al are near commercialization. This paper describes the melting, processing, mechanical properties, physical properties, corrosion, and weldability of these alloys. Applications for nickel aluminides have been identified. Potential suppliers who have recently licensed the nickel aluminide technology from Oak Ridge National Laboratory (ORNL) are also listed. 16 refs., 7 figs., 7 tabs.

48973 (CONF-880855—4) Recent developments in aluminides and silicides. Liu, C.T.; Oliver, W.C.; McKamey, C.G.; Porter, W.D.; George, E.P. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 16p. NTIS, PC A03. Order Number TI88012926/JAW.

From 2. international SAMPE metals and metals processing conference; Dayton, OH, USA (2 Aug 1988).

This paper summarizes recent alloy development in Ni_3Al, Ni_3Si, Fe_3Al, and Al_3Ti, alloys at ORNL. Micro- alloying with boron suppresses brittle intergranular fracture and dramatically improves ductilities of Ni_3Al and Ni_3Si with hypostoichiometric compositions. Chromium additions reduce environmental embrittlement and increase the ductility of the alloys at elevated temperatures. Alloying with chromium also reduces brittle cleavage fracture and enhances tensile ductility in Fe_3Al, alloys. Hardness measurements reveal that Al_3Ti alloys with the $L1_2$ structure, stabilized by Ni, Fe, and Cu, retain their strength at high temperatures. Ductile nickel and iron aluminides and silicides developed at ORNL have the potential to be used as new engineering materials for elevated-temperature structural use. 44 refs., 12 figs., 2 tabs.

48974 (CONF-880922—1) Laser welding of stainless steel weld filler metals at high cooling rates. Vitek, J.M.; David, S.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88002345/JAW.

From 4. international symposium on welding and melting by electron and laser beams; Cannes, France (26 Sep 1988).

Several stainless steels were laser welded under conditions resulting in high cooling rates of the welds. Significant changes in the microstructures, compared to those produced by conventional welding techniques, were found. For alloys 304, 308, 309, 316 and 347, a general decrease in ferrite content with increasing cooling rate was found. For three alloys (304, 308, 347), a fully austenitic structure was obtained at the highest cooling rates. For alloys 312 and 446, the high cooling rates retarded the formation of austenite, resulting in higher ferrite contents and fully ferritic structures at the highest cooling rates. Only for alloy 310 was the microstructure after laser welding comparable to that found after conventional welding. The results are discussed in terms of their impact on the Schaeffler diagram and its applicability to laser welding. 11 refs., 7 figs.

48975 (CONF-880950—1) Laser Raman spectroscopy of anodic corrosion and inhibitor films on iron and nickel. Melendres, C.A.; Tipton, T.; Camillone, N. III. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88009958/JAW.

From 11. international conference on raman spectroscopy; London, UK (5 Sep 1988).

Recent results are reported from studies of corrosion films formed on iron in phosphate and chromate solutions as well as inhibitor films formed on nickel in an acidic chloride environment. The surface films were prepared by constant potential electrolysis in 0.1 M solutions of the appropriate salt, then examined {open quotes}in-situ{close quotes} and {open quotes}ex-situ.{close quotes}. The spectrometer consisted of a SPEX model 1403 double monochromator fitted with a photomultiplier tube detector. Excitation was by the use of a Coherent Radiation model CR6 Ar/sup plus/ laser using the 514.5 nm line at power levels between 50 and 150 mW. 2 figs.

48976 (DOE/CE/30839—T1) Rotary combustor and boiler tubes after long term service: A materials evaluation: Municipal solid waste subscale rotary combustor program: Topical report. Whitlow, G.A. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 1 Nov 1986. Contract FC01-85CE30839. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015586/JAW.

A metallurgical evaluation of sections of combustor and superheater tubing removed after 27,500 hours of exposure in the Westinghouse-O'Connor, waste-to-energy facility at Gallatin, Tennessee, has been performed. Both of these carbon steel components have withstood an aggressive, corrosion/erosion environment with minimal metal wastage, which augurs well for safe, reliable service to continue for the foreseeable future. Extensive deposition of chlorides and sulfates occurred on the exposed surfaces, but due to the relatively low metal temperatures involved little interaction with the carbon steel surfaces was observed. 2 refs., 15 figs., 3 tabs.

48977 (DOE/ER/01198—T19) Growth and properties of superlattices with antiferromagnetic rare earths. Flynn, C.P.; Borchers, J.A.; Demers, R.T.; Du, R.R.; Dura, J.A.; Klein, M.V.; Kong, S.H.; Salamon, M.B.; Tsui, T.F.; Yadavalli, S.; Zhu, X.; Zabel, H.; Cunningham, J.E.; Erwin, R.W.; Rhyne, J.J. (Illinois Univ., Urbana (USA). Dept. of Physics; AT and T Bell Labs., Holmdel, NJ (USA); National Bureau of Standards, Washington, DC (USA)). 1988. Contract AC02-76ER01198. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014628/JAW.

The conditions under which high quality metal superlattices can be grown with sharp flat interfaces are described. The discussion is illustrated by examples that include the growth of rare earth superlattices in chosen orientations. It is emphasized that epitaxy makes the structure and properties of thin films differ from those of the bulk. In particular, the clamping of a magnetic film by its substrate modifies the magnetoelastic energy and consequently change the magnetic phase diagrams of individual layers. Experiments using MBE-grown antiferromagnetic rare earths films and their superlattices with Y are discussed in the light of these observations. 30 refs., 10 figs.

48978 (DOE/ER/01198—T24) Experimental and theoretical study of inclusions during initiation of crevice corrosion. Lott, S.E. (Illinois Univ., Urbana (USA). Graduate Coll.). 1987. Contract AC02-76ER01198. 101p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88014993/JAW.

The initiation sites of crevice corrosion on stainless steel are generally recognized to be sulfide inclusions (MnS), although the mechanism by which the initiation occurs remains unknown. Controlled solution experiments showed that the products of the MnS electrochemical oxidation reaction were elemental sulfur and thiosulfate. Spectroelectrochemical cell experiments on MnS quantified the electrochemical production of thiosulfate. This finding linked the metallurgical and solution phases and suggested a depassivation mechanism based on a critical crevice solution composition. The range of thiosulfate and chloride ion concentrations in which the stainless steel oxide film remained passive was determined. All other species present in the crevice were shown not to influence depassivation. From the proposed mechanism a mathematical model was developed to determine the position and time of breakdown in the crevice based on transport of species by migration and diffusion, electrochemical kinetics, and potential field theory. Instrumented artificial crevices cell experiments were conducted to test the validity of the model and the proposed mechanism. The crevice cell geometry had a variable crevice height of 2.7 to 9.2 +- 0.2 μm and a depth of 1.27 cm; very good agreement between the experiments and the model was found for the conditions for avoiding crevice corrosion. The model was inverted in order to suggest the design criteria for achieving corrosion free crevices. 55 refs., 39 figs., 6 tabs.

48979 (DOE/ER/45172—T1) Implantation studies of hydrogen by field ion microscopy and spectroscopy: Final report. Verink, E.D. Jr.; DeHoff, R.T.; Hren, J.J. (Florida Univ., Gainesville (USA). Dept. of Materials Science and Engineering). 1988. Contract FG05-84ER45172. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015806/JAW.

The depth resolution of the Field Ion Microscope/Imaging Atom Probe (FIM/IAP) is of the order of a crystal d-spacing of the metal under investigations. The current study involved the application if the FIM/IAP to the study of low energy ions (<20 keV) implanted into metals to obtain depth profiles. Two ion species of immense technological importance were used, nitrogen and deuterium. Results of this investigation fall into four categories: (1) instrumentation development, (2) development of new experimental techniques, (3) the generation and interpretation of experimental data and (4) the determination of a number of characteristics of

FIM which can influence the interpretation of experimental observations.

48980 (DOE/ER/45203—4) Influence of grain boundary structure distribution and processing history on intergranular creep cavitation: Final report. Adams, B.L. (Brigham Young Univ., Provo, UT (USA). Dept. of Mechanical Engineering). 1988. Contract FG02-85ER45203. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015808/JAW.

A new measure of grain boundary structure in polycrystalline materials has been introduced which overcomes two difficult obstacles in modeling properties. Previous microstructural measures described intercrystalline misorientation and boundary physical orientation separately. The new measure, called the Intercrystalline Structure Distribution Function, successfully combines both of these elements into a single cohesive measure application to a wide class of property models. A method for determining the function from microdiffraction measurements in section planes was developed. 17 refs., 4 figs.

48981 (DOE/ER/52139—T1) Helium induced weldability degradation in an austenitic stainless steel. Lin, H.T.; Grossbeck, M.L.; Goods, S.H.; Chin, B.A. (Auburn Univ., AL (USA); Oak Ridge National Lab., TN (USA); Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract FG05-86ER52139;AC05-84OR21400;AC04-76DP00789. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014739/JAW.

Autogenous gas tungsten arc (GTA) welding was performed on He-doped type 316 stainless steel. Helium was uniformly implanted in the material using the "tritium trick" to levels of 27 and 105 appM. Catastrophic brittle failure occurred in both fusion and heat-affected zones upon cooling of the weld. Microstructural observations of the fusion zone indicate that the pore size, degree of porosity and tendency to form cracks increases with increasing helium concentration. Scanning electron micrographs conclusively show that the weld failure of He-doped materials is due to the precipitation of helium bubbles on grain boundaries and dendrite interfaces. Results of the present study demonstrate that the use of conventional welding techniques to repair or refurbish materials degraded by exposure to irradiation environments may not be feasible if the irradiation results in the generation of even relatively small amounts of helium. 25 refs., 8 figs., 1 tab.

48982 (EGG-MS—8000) Joining of advanced aluminides: Final report. Clark, D. E. (EG and G Idaho, Inc., Idaho Falls (USA)). Mar 1988. Contract AC07-76ID01570. 47p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015111/JAW.

The weldability of four Ni{sub 3}Al-8% Cr alloys (IC-221, and two low- Zr modifications) was investigated. Solidification segregation during base metal production decreases weldability by creating low-melting regions susceptible to hot cracking during welding. Extrusion, hot rolling, and annealing procedures were developed to homogenize the base metal microstructure, solving this problem. Weldability was evaluated with the gas tungsten arc welding process and heat-affected zone simulation (Gleeble testing) as a function of Zr content, preheat temperature, and weld travel speed. Weld cracking occurred in the fusion zone; no cracks originated in base material or HAZ. Cracking increased with Zr content at low Zr levels, increased with welding speed, and decreased with preheat. At higher Zr levels, hot cracking was severe, possibly due to a Zr-Ni eutectic. An interdendritic phase present at higher welding speeds, apparently {beta}{prime}, is strongly enriched in Ar, and may be associated with weld cracking. Antiphase domains consisting of ordered {gamma}{prime} material surrounded by disordered {gamma} form on rapid cooling and depend in size on welding or simulated welding cooling rates, and can be expected to affect weld metal properties. The high temperature welding thermal cycle properties of reduced Zr materials are comparable to those of the higher-Zr IC-218 and IC-221. 29 figs., 4 tabs.

48983 (EPRI-CS—5252-Vol.6) Dissimilar-welded failure analysis and development: Volume 6, Weld condition and remaining life assessment manual: Final report. (Electric Power Research Inst., Palo Alto, CA (USA); Materials Properties Council, Inc., New York (USA)). Aug 1988. 128p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016218/JAW.

Step-by-step guidelines contained in a new engineering manual explain how to evaluate dissimilar metal weld loadings, assess the current state of damage, and predict remaining weld life. Suggested plant and operational modifications will help utility personnel identify root causes and avoid additional failures in a given boiler. Failure of dissimilar metal welds (DMWs) between the austenitic and ferritic steel tubing used in superheaters and reheaters constitutes a major cause of forced outages in fossil boilers. EPRI has undertaken a study of DMWs, reported in volumes 1-6 of this nine-volume series, to provide utilities with a systematic approach for identifying root causes, remedying identified problems, and estimating remaining DMW useful life. This manual follows the three-phase approach outlined in the EPRI guidelines for life extension (report CS-4778). The investigators subjected the samples to detailed metallurgical examination and established correlations among operating conditions, system stresses, and the extent of observed DMW cracking. These correlations were quantified in the PODIS computer code (prediction of damage in service code; EPRI report CS-4252, volume 7). The investigators documented this information in a manual explaining how to carry out life assessment of DMWs. These guidelines describe an analytic procedure that computes the current level of DMW damage based on operating temperature, the number and nature of cycles, and system stresses. They explain a procedure for supplementary destructive examinations to verify the analytic predictions. 10 refs., 20 figs., 2 tabs.

48984 (INIS-BR—1147-Vol.1, pp 335-344) Effects of alloy elements. Impurities and microstructure factors in austenitic alloy steels, used in fuel rods of nuclear power plants. Yoshimoto, A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Austenitic Stainless Steel is used as cladding material of pressurized water reactor fuel rods because of its good performance. The addition of alloy elements and the control of impurities make this to happen. Fission products do not contribute to corrosion. Dimensional changes are not critical up to 1,0x10/sup 22/n/cm/sup 2/ (E>0,1 Mev) of neutronic doses. The hydrogen does not cause embrittlement in the reactor operation temperatures, and helium contributes to embrittlement in the material is warmed upon 650/sup 0/ C.

48985 (INIS-BR—1157, pp 62) Production and analysis of superconductor alloys (A-15 type). Pereira, R.F.R.; Silveira, M.F. da; Meyer, E. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1981. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88703560/JAW. (CONF-8109291—).

From 7. Latin American symposium on solid state physics; Gramado, Brazil (14 Sep 1981).

48986 (IRIM—8702) Study on composite molybdenum sulphate. (National Inst. for Researches in Inorganic Materials, Tokyo (Japan)). 20 Nov 1987. 94p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88753449/JAW.

This paper outlines the study conducted under the subject for research of 'Composite Molybdenum Sulphate' from April, 1982 to March, 1987. It is known that molybdenum chalogenite containing Chevrel phase among the three-component sulphate, M (metallic atom)-Mo-S, shows superconductivity. Although it is indispensable for developing the superconducting materials to establish the synthetic conditions and elucidate the indeterminate ratio composition, the phase diagram has not been completed yet. The purpose of

the study was to obtain the basic data required for making clear the relationship between the composition, structure and physical properties by conducting the crystallochemical study focusing on the elucidation of phase relationship of some three-component composites, M-Mo-S, containing a transition metal or rare earth atom as the M-atom and to find new compounds. This paper presents the results of study on the phase relationship and growth of single crystal and the crystalline structure and physical properties. (89 figs, 55 tabs, 158 refs)

48987 (KURRI-TR—296, pp 37-41) **Studies of ion irradiation effects by CEMS.** Hayashi, Nobuyuki; Sakamoto, Tsutomu; Toriyama, Tamotsu. (Electrotechnical Lab., Sakura, Ibaraki (Japan)). Nov 1987. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88900377/JAW. (CONF-8707148—).

From 1. KUR symposium on hyperfine interactions; Kyoto, Japan (20 Jul 1987).

Effects of ion irradiation is observed by conversion electron Moessbauer spectroscopy (SEMS) to investigate the crystallization process of Fe-B amorphous alloys and phase transformation of austenitic steel. Measurement by differential CEMS (DSEMS) show that irradiation has large effects on the surface of samples, indicating that the outermost surface of amorphous alloys is very likely to undergo crystallization. It is also revealed that irradiation-induced martensite transformation in stainless steel is attributed to an increase in internal stress due to formation of bubbles, etc. Depth profiling investigation shows that the proportional counter is inferior to other tools such as CMA detector with respect to energy resolution, and consequently depth resolution. However, its counting efficiency is high and measurements can be made simultaneously for various energy regions, permitting measurement for ordinary non-/sup 57/Fe-enriched samples without using a strong radiation source. All these results indicate that DCEMS is useful for studies on irradiation effects. (Nogami, K.).

48988 (LA-UR—88-540) **Laser plume temperature measurements in various gases.** Lewis, G.K.; Cremers, D.A.; Dixon, R.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-880922—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006462/JAW.

From 4. international symposium on welding and melting by electron and laser beams; Cannes, France (26 Sep 1988).

Nd-YAG laser plume temperatures of 3000–5400K were measured on 304 stainless steel and 1100 Al in various gases using emission spectroscopy. Temperatures were higher in the reactive gases air, 02, and SF6, compared to inert gases. Ionic spectra were not observed, indicating that the plume primarily consists of hot vapors and does not contain a plasma, in contrast to CO_2 laser processing in which plasmas have been observed. The plume temperature remained constant with changes in laser power and with time during the duration of the laser pulse. Light emissions from the plume and from the cooling weld pool after the laser pulse was off were measured and correlated with melt depth. 7 refs.

48989 (LA-UR—88-1001) **Characterization of dynamic fracture in copper under uniaxial stress and uniaxial strain.** Zurek, A.K.; Johnson, J.N.; Frantz, C.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-880940—1). NTIS, PC A02. Order Number DE88007824/JAW.

From 2. international conference on mechanical and physical behavior of materials under dynamic loading; Ajaccio, France (19 Sep 1988).

We have characterized fracture modes in copper under conditions of dynamic uniaxial tension (expanding ring tests) and dynamic uniaxial strain (spall tests). The spall strength in copper was measured as a function of grain size, purity and initial porosity. A unified model for ductile fracture is developed, and a qualitative prediction of the relative magnitudes of porosity and plastic deformational strain for spall and uniaxial tension tests is presented. 17 refs., 6 figs.

48990 (LA-UR—88-1167) **Metastable alloy phases prepared by solid state reactions and ball milling.** Schwarz, R.B. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 20p. (CONF-880844—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88009156/JAW.

From 8. international conference on strength of metals and alloys; Tampere, Finland (22 Aug 1988).

The main methods of synthesis of amorphous metallic alloys are based on (1) the rapid solidification of alloys from the liquid or vapor phase, (2) solid state interdiffusion reactions between pure metals having negative heats of mixing, and (3) mechanical attrition of crystalline intermetallics. We describe methods (2) and (3), developed around 1983, and we discuss recent advances in the understanding of the glass forming ranges for the three methods of synthesis. 43 refs., 10 figs.

48991 (LA-UR—88-1168) **The influence of texture on strain hardening.** Kocks, U.F.; Stout, M.G.; Rollett, A.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 11p. (CONF-880844—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88009157/JAW.

From 8. international conference on strength of metals and alloys; Tampere, Finland (22 Aug 1988).

It is well known that the strain hardening behavior of metals is not the same in tension, compression, torsion and rolling, for example. We report on a new set of experiments, comprising wire-drawing interrupted by tensile tests, free compression, channel-die compression, and short-tube torsion in aluminum, an Al-Mg alloy, copper, silver, and 70:30 brass. The texture was measured before straining and at vonMises strain levels of roughly 1.0 and 2.0. Computer simulations of the deformation starting from a set of random grains weighted by observed initial texture, predicted deformation textures in qualitative agreement with the observed ones in most cases. Quantitatively the simulations yielded the Taylor factors as a function of strain for all paths and, with an assumed hardening law for the representative grain, the macroscopic stress/strain curves. The grain hardening rate as a function of resolved shear stress was described in tabular form such as to match one of the macroscopic curves, and then used to predict the others. The eventual fit was quite good; we will describe what judgments needed to be made to achieve this result. The conclusion is that the strain-path dependence of work hardening can be explained simply as a consequence of texture development. 13 refs., 5 figs., 1 tab.

48992 (LA-UR—88-1960) **Near surface chemistry and corrosion behavior of excimer laser surface-melted AISI type 304 stainless steel.** Baer, D.R.; Frydrych, D.J.; Jervis, T.R. (Pacific Northwest Lab., Richland, WA (USA); Los Alamos National Lab., NM (USA)). May 1988. Contract W-7405-ENG-36;AC06-76RL01830. 13p. (CONF-8809107—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014440/JAW.

From Symposium on environmental degradation of ion and laser beam treated surfaces; Chicago, IL, USA (25 Sep 1988).

The effects of excimer laser surface melting on the near-surface chemistry, and corrosion behavior of AISI 304 stainless steel have been examined as a function of total energy deposited on the specimen. The surface chemistry resulting from the laser treatments has been examined using Auger electron spectroscopy. Electrochemical methods were used to monitor the corrosion behavior of the specimens in deaerated 0.1 M NaCl. Electron microscopy was used to characterize the extent of local corrosion of the specimens. Laser treatment was observed to increase the chromium concentration of the surface oxide and to reduce the number of pits. Two types of pits were observed on untreated material, but only one type of pit occurred after laser treatment. 7 refs., 5 figs.

48993 (LA-UR—88-2128) **Structure of grain boundaries in iron.** Harrison, R.J.; Spaepen, F.; Voter, A.F.; Chen, Shao-Ping. (Army Materials Research Agency, Watertown, MA (USA). Materials Technology Lab.; Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences; Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 26p. (CONF-8708268—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014412/JAW.

From 34. Sagamore army materials research; Lake George, NY, USA (31 Aug 1987).

The present research has been carried out as part of the Steel Research Group's program to improve the properties of ultra-high- strength steels. It is an investigation of the mechanism of cohesion at grain boundaries as a step toward the design of alloy steel with improved resistance against boundary decohesion under stress corrosion conditions. This research involves a theoretical study of grain boundaries in iron alloys, examining the mechanism of cohesion as affected by structure including imperfections, by the average alloy composition and by segregation at the boundaries. This paper summarizes what we have done to date in obtaining approximate grain boundary structures. We have tested the approximate interatomic potential for iron which we have obtained by using it to compute the interplanar spacings at the surface and then comparing the computed results with experimental observations. Results are discussed. 51 refs., 9 figs., 3 tabs.

48994 **(LA-UR—88-2260) Theoretical studies of grain boundaries in Ni, Al, and Ni{sub 3}Al with and without boron.** Chen, S.P.; Voter, A.F.; Albers, R.C.; Boring, A.M.; Hay, P.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-880408—34). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014323/JAW.

From Spring meeting of the Materials Research Society; Reno, NV, USA (4 Apr 1988).

Atomistic simulations of [001] symmetric tilt grain boundaries in Ni, Al, and Ni{sub 3}Al are presented. The atomistic structures of the simulated grain boundaries have been analyzed in terms of the structural unit model, which is found to be of limited utility for intermetallics. Simulation results show that boron segregates more strongly to grain boundaries than to free surfaces, and strengthens the grain boundary. Good cohesive properties of the grain boundaries occur when both boron and some segregated Ni are present. The Ni and B are found to co-segregate to the Ni{sub 3}Al boundary with an energy advantage of {approximately}0.5 eV. 17 refs., 3 figs.

48995 **(LBL—24987) Tensile properties of commercial aluminum-lithium alloys at cryogenic temperatures.** Glazer, J.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Mar 1988. Contract AC03-76SF00098. 12p. (CONF-8803135—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014857/JAW.

From Aluminum-lithium symposium; Los Angeles, CA, USA (22 Mar 1988).

The mechanical properties of commercially available aluminum alloys at cryogenic temperatures have attracted increasing interest in the past few years because of the large number of potential aerospace applications, primarily in tankage for cryogenic fuels. Aluminum-lithium alloys are of particular interest because of their low density and the extremely good low temperature properties that have been measured to date. This paper compares the behavior of AA 2090-T81 plate and AA 2091-T8 plate, which has not previously been surveyed. The 2090 data include new results at 200 K that indicate that property trends are not monotonic with temperature. The 2091 results show a peak in properties between 77 K and 200 K. These data point to the hazards of doing property screening at 77 K rather than 4 K. They also suggest some avenues for further exploration of the mechanisms that control elongation and fracture toughness. 6 refs., 3 figs., 3 tabs.

48996 **(NUREG/CP—0075) CSNI/NRC workshop on ductile piping fracture mechanics: Proceedings.** Kanninen, M.F. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Oak Ridge National Lab., TN (USA); Organization for Economic Co-Operation and Development, 75 - Paris (France); Southwest Research Inst., San Antonio, TX (USA)). May 1988. 162p. (CONF-8406371—; CSNI—97). NTIS, PC A08/MF A01 - GPO. Order Number TI88013250/JAW.

From CSNI/NRC workshop on ductile piping fracture mechanics; San Antonio, TX, USA (21 Jun 1984).

This report contains the papers presented at a workshop meeting that was conducted to compare the various different elastic-plastic fracture mechanics analysis methods that can be applied to assess the margin of safety in cracked nuclear plant pipes. A specific problem -- a circumferentially cracked Type 304 stainless steel pipe in combined axial tension and bending -- was addressed. The applied bending moments at crack growth initiation and at fracture instability were sought. Seven estimation type solutions were performed along with a benchmark elastic-plastic finite element solution. It was learned that precise specification of the material stress-strain curve must be made to obtain meaningful results. But, when applied under controlled conditions, the different estimation method solutions do provide reasonably consistent results. These results appear to be conservative in comparison with an elastic-plastic finite element solution that was performed to provide a comparison with these results. Individual papers have been entered into EDB and ERA.

48997 **(ORNL/TM—10709) Micromechanisms of deformation and fracture in ordered intermetallic alloys: 1, Strengthening mechanisms.** Yoo, M.H.; Horton, J.A.; Liu, C.T. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number TI88015382/JAW.

The stability and mobility of active slip and twin modes in superlattice structures, for both cubic and noncubic crystals, are theoretically investigated based on the energetics and kinetics of dislocation dissociations. The main concept of the force couplet model for the positive temperature dependence of yield and flow stresses is introduced. Two sources of the glide resistance in ordered lattices are the fault dragging mechanism and the cross-slip pinning mechanism. The effective fault energy consists of two terms related to the chemical and mechanical instability of a shear fault (antiphase boundary, superlattice intrinsic stacking fault, or microtwin). Dependence of the yield stress on the orientation and the sense of applied stress stems from the signs and magnitudes of the glide and nonglide stresses. As the effective fault energy is altered by solute segregation and/or high nonglide stress, the two glide resistance mechanisms are affected differently. In Ni_3Al and β-CuZn, the major aspects of anomalous yield strength, strain rate sensitivity, in situ deformation transmission electron microscopy observations, microtwinning, and nonstoichiometry effect are discussed in view of the present model. In addition, the order twinning-slip conjugate relationship is identified, in all the superlattice structures considered, which will influence the deformation behavior by viscous glide at high temperatures. 106 refs., 17 figs., 5 tabs.

48998 **(PB—88-213012/XAB) Investigation of commercial materials for armour pentrating projectiles.** Ekbom, L.; Ostensson, M.; Hellner, L. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Mar 1988. 25p. (In Swedish). (FOA-C—20705-2.1). NTIS, PC E03/MF A01.

The properties of today's commercial tungsten alloys. This type of heavy metal is used as material for armor-penetrating projectiles. The investigation was initiated in cooperation with FMV-Am2, FFV Materialteknik and Bofors Forsvarsmateriel. The investigations were divided between the laboratories so that the proportions were about the same at FOA, FFV, and Bofors. The results show that the quality of the commercial alloys is improved since the beginning of the 1970's. The different producers have about the same product quality. However, as in the earlier investigation, there are variations in the quality, which depend on a lack of production control.

48999 **(PB—88-866603/XAB) Chemical vapor deposition. August 1984-July 1988 (Citations from the NTIS data base). Report for August 1984-July 1988.** (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 244p. NTIS PC N01/MF N01.

Supersedes PB—87-864542.

This bibliography contains citations concerning chemical vapor deposition of carbon, carbides, ceramics, metals, and glasses. Applications include optical coatings, semiconducting films, laser materials, solar cells, composite fabrication, and nuclear reactor material fabrication. Included are the physical and chemical properties of these coatings. (This updated bibliography contains 385 citations, 183 of which are new entries to the previous edition.)

49000 (PNL-SA—15347) Charpy impact test results of ferritic alloys irradiated to 10 DPA at 55{degree}C. Wu, W. L.; Gelles, D. S. (Pacific Northwest Lab., Richland, WA (USA); Westinghouse Hanford Co., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 11p. (CONF-880613—19). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014753/JAW.

From 14. international symposium on effects of radiation on materials; Andover, MA, USA (27 Jun 1988).

Miniature Charpy specimens of HT-9 in base metal, weld metal and heat affected zone (HAZ) metal conditions, and 9Cr-1Mo in base metal and weld metal conditions have been tested following irradiation in the High Flux Isotope Reactor (HFIR) at 55{degree}C to {approximately}5 and 10 dpa. All specimens conditions are found to have degraded properties (both DBTT and USE). 9Cr-Mo degraded more than HT-9 and weld material performed worse than base metal which performed worse than HAZ material. As a function of dose, property degradation was approximately linear, indicating that degradation response had not saturated by 10 dpa. 11 refs., 2 figs., 3 tabs.

49001 (SAND—88-0750C) The catalytic, structural, and electronic properties of strained-metal overlayers. Goodman, D.W. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-880939—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88007932/JAW.

From Symposium on preparation and characterization of catalysts; Los Angeles, CA, USA (25 Sep 1988).

The present studies are part of a continuing effort to identify those properties of bimetallic systems which can be related to their superior catalytic properties. A pivotal question to be addressed of bimetallic systems (and of surface impurities in general) is the relative importance of ensemble (steric or local) versus electronic (nonlocal or extended) effects in the modification of catalytic properties. A complete understanding of surface impurity effects (including alloying) in catalysis will likely include components of both electronic and ensemble effects, the relative importance of each to be assessed for a given reaction and reaction conditions. An emphasis of our research has been to address the importance of these two effects regarding the influence of alloying and surface additives on surface reactions. Systems discussed are Cu/Ru and Ni/W. 17 refs., 1 tab.

49002 (SAND—88-2055C) The characteristics of ultrafine particles produced freeze-drying and by precipitation. Panitz, J.K.G. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 17p. (CONF-880789—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014520/JAW.

From Advanced materials workshop; Livermore, CA, USA (26 Jul 1988).

We have investigated the characteristics of powders produced by two techniques: (1) freeze-drying, and (2) precipitation from a liquid medium. Powders of ionic compounds: RbCl and TlF have been produced by freeze-drying. By optimizing this technique, it is possible to produce powders comprising small, 10 μm agglomerates of primary particles with average sizes between 0.1–0.5 μm. These agglomerates can be broken into primary particles by sonication. We have also precipitated RbCl and TlF powders from an aqueous solution by adding isopropanol. These powders consist of large agglomerates of primary particles, 0.5 μm to 10 μm in size, which do not respond well to sonication, but may be subdivided by mechanical milling. We have also adapted a chemical precipitation technique for producing 0.2 μm diameter primary particles of Y_2O_3. 4 refs., 5 figs.

49003 (UCRL—97782-Rev.1) Deflection of light by using tungsten bronze crystals. Jelsma, L.F.; McWright, G.M.; Schumacher, F.A.; Neurgaonkar, R.R. (Lawrence Livermore National Lab., CA (USA); Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). 5 Jul 1988. Contract W-7405-ENG-48. 7p. (CONF-8809111—1-Rev.1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014151/JAW.

From Optoelectronic materials and devices II; Boston, MA, USA (6 Sep 1988).

This paper reports our preliminary results on an electrooptical light deflector for streak camera applications that uses tungsten bronze SBN:60% crystals. We found the performance of these ferroelectric crystals to be an order of magnitude better than the best $LiNbO_3$ crystals currently available. We discuss the theory and performance of this crystal as well as other bronze crystals for application to the streak camera. 8 refs., 5 figs., 2 tabs.

49004 (UCRL—98126) Applications of process modelling to heat treatment of superalloys. Shapiro, A.B.; Wallis, R. (Lawrence Livermore National Lab., CA (USA)). Jul 1988. Contract W-7405-ENG-48. 24p. (CONF-880259—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015445/JAW.

From Metal forming modeling subgroup of IMOG; Los Alamos, NM, USA (23 Feb 1988).

Finite element models using the LLNL TOPAZ and NIKE codes have been used to determine the quenching media required to give the cooling rates necessary to meet the property specifications for superalloy components. They have also been used, qualitatively, to reduce the residual stresses developed during quenching with a subsequent reduction in distortion problems during machining. A further application has been the elimination of cracking during the quenching of crack-sensitive alloys.

49005 (UCRL—98881) Pressure effects on the electronic structure of 4f and 5f materials. McMahan, A.K. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 22p. (CONF-880914—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014149/JAW.

From 18. rare earth research conference; Lake Geneva, WI, USA (11 Sep 1988).

The γ-α transition in Ce has been the focus of considerable theoretical effort. It has been attributed to a Mott- like transition of the 4f electrons from localized to itinerant character, as well as to volume sensitivity of the Kondo binding energy, to mention two of the competing explanations. Less attention has been directed towards analogous transitions observed at higher pressures in Pr, Nd, and Sm among the elemental 4f metals; and in Am, Cm, Bk, and Cf among the 5f metals. This paper reviews our current theoretical understanding of the evolution in electronic structure which underlies these dramatic transitions in compressed 4f and 5f materials. 42 refs., 3 figs.

49006 (WNS/ASD—88-02) Dynamic fracture toughness evaluation by measurement of CTOD. Sharpe, W.N. Jr.; Douglas, A.S.; Shapiro, J.M. (Johns Hopkins Univ., Baltimore, MD (USA)). Feb 1988. 89p. NTIS, PC A05/MF A01.

Quantification of the dynamic fracture toughness of structural materials is essential to a wide range of problems-from nuclear accidents to ordnance applications. However, the difficulties associated with accurate measurements of crack under dynamic loading are considerable. Thus there are no standardized procedures and few reliable results. A systematic study of the dynamic fracture toughness of SAE-01 tool steel, 4340 and HY100 steels, and a tungsten are described using the Interferometric Strain/Displacement Gage (ISDG) system which has very high frequency resolution. The ISDG system is used to measure the crack tip opening displacement (CTOD) 100 microns behind a fatigue crack tip in a three-point bend specimen. Static measurements on similar specimens serve to calibrate the method and ensure consistency with the accepted procedures for static fracture toughness testing. Finite element analyses are used to obtain full field information at the point of initiation and to assess the material characteristics which lead to changes in toughness with loading rate. The major advantage of the method is that information is obtained very close to the crack tip, so that stress wave loading effects are accounted for. Results show that 4340 steel, which is strain-rate insensitive, has no significant change in toughness with loading rate. Measurable toughness dependence on loading rate is found for HY-100 and tungsten, which are approximately 15 percent tougher under dynamic conditions. The SAE-01 tool steel shows a significant increase (50 percent) in fracture toughness for dynamic over static loading.

49007 **Growth, structure, and physical properties of single-phase metastable fcc Cu/sub 1-//sub x/Cr/sub x/ solid solutions.** McIntyre, D.; Sundgren, J.; Greene, J.E. (Department of Materials Science, the Coordinated Science Laboratory, and the Material Research Laboratory, University of Illinois, 1101 W. Springfield Ave., Urbana, Illinois, 61801). *Journal of Applied Physics;* **64**: No. 7, 3689-3696(1 Oct 1988).

Single-phase fcc-structure metastable Cu/sub 1-//sub x/Cr/sub x/ alloys have been grown with Cr concentrations of up to 23 at. %. The films, which were typically 1.5—3 μm thick, were deposited by rf co-sputter deposition onto glass and oxidized-Si substrates at temperature between 55 and 180 °C. The average grain size of alloys grown at 90 °C was ~100 nm. The lattice parameter of Cu/sub 1-//sub x/Cr/sub x/ was found to increase linearly with x resulting in an effective fcc Cr radius, in solution, of 0.1332 nm. ~7% larger than the elemental bcc Cr bonding radius. The room-temperature resistivity of these alloys also increased linearly with x at a rate of 2.8 μΩ cm per at. % Cr. This high differential resistivity was due, in addition to simple alloys scattering, to scattering of conduction electrons into virtual bound states associated with the Cr atoms. Cu/sub 0.9/Cr/sub 0.1/ alloys were found to be stable for 24-h anneals at temperatures up to ~300 °C. From an analysis of x-ray diffraction peak positions and widths as a function of both growth and annealing temperatures, we conclude that the reaction path for the phase transition from the metastable to the equilibrium state involves first the precipitation of coherent fcc Cr particles followed by a transformation to bcc Cr as phase separation continues. The oxidation rate of Cu/sub 0.9/Cr/sub 0.1/ was found to be much less that that of pure Cu. At an annealing temperature of 250 °C, the oxide thickness t/sub ox/ on Cu/sub 0.9/Cr/sub 0.1/ saturated at J25 nm after 1 h while t/sub ox/ on Cu continued to increase parabolically with time from ~60 nm at 1 h to 140 nm at 4 h.

49008 **Hydrogen-deuterium reactions on palladium-iron bilayers: A permeation investigation.** Kuhn, D.K.; Johnson, H.H. (Department of Material Science and Engineering, Cornell University, Ithaca, New York 14853). *Journal of Applied Physics;* **64**: No. 7, 3461-3467(1 Oct 1988).

The permeation of hydrogen, deuterium, and hydrogen-deuterium through iron coated with thin surface films of palladium has been measured. The experimental steady-state fluxes show the expected isotope diffusivity dependence in iron. A new observation is that hydrogen and deuterium react on the palladium surface to form HD, and this affects the permeation fluxes. The results are in good agreement with a model incorporating second-order surface kinetics which allow for competition between hydrogen and deuterium for surface sites. The theory predicts that the hydrogen/deuterium surface coverage ratio on palladium is ~4 at room temperature for equal H_2 and D_2 pressures.

49009 **Sequence of phase formation in Nb/Al multilayered samples.** Im, Y.; Morris J.W. Jr. (Center for Advanced Materials, Lawrence Berkeley Laboratory, Department of Materials Science and Engineering, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **64**: No. 7, 3487-3491(1 Oct 1988).

A series of Nb/Al multilayered samples made by a sputter-deposition or a cold-rolling technique was used to simulate reactions in powder metallurgy processed Nb/Al superconducting wires. The sequence of phase formation observed in the Nb/Al multilayered samples was explained using knowledge about the crystal structure of each compound. Three different controlling mechanisms were proposed: the activation energy for nucleation, the energy barrier associated with short range order, and the diffusion barrier by the previously formed phase layer.

49010 **Stress-induced changes in the magnetic properties of some nickel-copper and nickel-cobalt alloys.** Jiles, D.C.; Chang, T.T.; Hougen, D.R.; Ranjan, R. (Center for Nondestructive Evaluation, Iowa State University, Ames, Iowa 50011). *Journal of Applied Physics;* **64**: No. 7, 3620-3628(1 Oct 1988).

This paper presents results on the magnetic properties of NiCu and NiCo alloys with compositions in the range 70%—100% Ni. Measurements include coercivity initial susceptibility, maximum differential susceptibility, magnetostriction, and Barkhausen effect emissions. Results revealed a surprising increase in the magnetostriction as a function of magnetic induction B as the copper content increased. The saturation magnetostriction λ/sub s/ was nevertheless found to decrease with copper content. The addition of cobalt reduced the magnitude of the magnetostriction resulting in a change of sign from negative to positive at between 20% and 30% cobalt. Coercivity was found to be little affected by elastic stress, but strongly affected by plastic deformation such as occurs, for example, in cold working. A similar result was true for initial susceptibility. Maximum differential susceptibility was, however, found to be strongly dependent on elastic stress. Results were interpreted in terms of stress induced uniaxial anisotropy. As the tensile stress increased the magnetization became more reversible, but the susceptibility decreased.

49011 **Palladium diffusion and cluster nucleation on Ta(110).** Schwoebel, P.R.; Kellogg, G.L. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review [Section] B: Condensed Matter;* **38**: No. 8, 5326-5331(15 Sep 1988).

The surface diffusion and initial stages of cluster nucleation of Pd adatoms on Ta(110) are investigated by field ion microscopy (FIM). The results indicate that Pd atoms become mobile on Ta(110) at 180 K and diffuse with an activation energy of 0.49 +-0.02 eV. The structure of small Pd clusters on the Ta(110) plane depends upon the number of Pd adatoms present on the plane. If fewer than nine Pd atoms are deposited on the plane, the stable configuration is a linear chain oriented along a close-packed direction of the substrate. Two-dimensional island clusters containing fewer than nine atoms are metastable. For nine or more adatoms, however, the stable configuration is a two-dimensional island cluster and the linear chain cluster is metastable. Field ion images of the two-dimensional island clusters indicate that the Pd overlayer is pseudomorphic up to, and including, approximate monolayer coverages. Two-dimensional Pd clusters migrate as a unit on Ta(110) at temperatures from ~250 to 325 K. Above ~350 K the clusters rapidly disappear from the plane. The results of this investigation are compared to other FIM data related to the nucleation of metal-adatom clusters.

49012 **Far-infrared absorptivity of UPt_3.** Sulewski, P.E.; Sievers, A.J.; Maple, M.B.; Torikachvili, M.S.; Smith, J.L.; Fisk, Z. (Laboratory of Atomic and Solid State Physics and Materials Science Center, Cornell University, Ithaca, New York 14853-2501). *Physical Review [Section] B: Condensed Matter;* **38**: No. 8, 5338-5352(15 Sep 1988).

The absorptivity of the heavy-fermion compound UPt_3 is measured from 2 to 1000 cm/sup -1/ (0.25—124 meV) at temperatures between 1.2 K and room temperature. Above 50 cm/sup -1/ (6.2 meV) the absorptivity is relatively temperature independent, while below that frequency the absorptivity is very temperature dependent, in accord with the dc resistivity. By performing a Kramers-Kronig transformation of the data, augmented with recently published results at higher frequencies, the complex conductivity is obtained. The low-temperature conductivity may be characterized by free carriers which undergo frequency-dependent scattering and have a concomitant frequency-dependent mass enhancement, $\lambda(\omega)$, with $\lambda(0) = 65$. The data indicate a bare free-carrier plasma frequency of 2.1 x 10^4 cm/sup -1/ (2.6 eV). Combining these results with the measured specific heat for UPt_3 gives for the low-frequency effective mass m/sup */ = 240m, and for the optical band mass m/sub b/ = 3.7m. The carrier density is close to one electron per formula unit. The far-infrared absorptivity measurement indicates that the scattering rate begins to rise with an ω^2 dependence, while the measured dc resistivity has a T^2 dependence at temperatures below 2 K. To account for the far-infrared data, the carrier scattering rate $\Gamma(\omega,T)$ can be written as $\Gamma(\omega,T) \sim \omega^2 + (p\pi T)^2$, with an experimental upper limit of $p = 1$. This is not consistent with electron-electron scattering, for which $p = 2$.

49013 **Simple theory of electronic structure: Clusters to crystals.** Liu, F.; Press, M.R.; Khanna, S.N.; Jena, P. (Physics Department, Virginia Commonwealth University, Richmond, Virginia 23284-2000). *Physical Review [Section] B: Condensed Matter;* **38**: No. 8, 5760-5763(15 Sep 1988).

A simple scheme based upon a cross between the molecular clusters and the tight-binding theory has been developed to calculate the electronic structure of a large class of systems ranging from molecules to solids. The method is applied to study the variations in the magnetic moments of Fe and Ni forming clusters, bulk, surfaces, thin films, and voids. The results are in good agreement with the state-of-the-art theoretical techniques and available experimental data. The present method has the additional advantage that it can be applied to imperfect systems with equal ease.

49014 **Effect of prestress on tensile yield strength of a Ni_3Al alloy.** Yoo, M.H.; Liu, C.T. (Metals and Ceramics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6115). *Journal of Materials Research;* **3**: No. 5, 845-847(Sep 1988).

An experimental technique of prestressing and quenching was employed in order to elucidate the nature of pinning points responsible for the anomalous yield strength of Ni_3Al. The apparent number density of pinning points at room temperature was found to be unaffected by the prestressing and quenching from elevated temperatures. This result is consistent with the cross-slip-pinning (CSP) model in that cross-slipped segments act as pinning points on the leading superpartial dislocations.

49015 **Slip, twinning, and fracture at a grain boundary in the $L1_2$ ordered structure: A $\Sigma = 9$ tilt boundary.** Yoo, M.H.; King, A.H. (Metals and Ceramics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Journal of Materials Research;* **3**: No. 5, 848-855(Sep 1988).

The role of interaction between slip dislocations and a $\Sigma = 9$ tilt boundary in localized microplastic deformation, cleavage, or intergranular fracture in the $L1_2$ ordered structure has been analyzed by using the anisotropic elasticity theory of dislocations and fracture. Screw superpartials cross slip easily at the boundary onto the (11-bar1) and the (001) planes at low and high temperatures, respectively. Transmission of primary slip dislocations onto the conjugate slip system occurs with a certain degree of difficulty, which is eased by localized disordering. When the transmission is impeded, cleavage fracture on the (1-bar11) plane is predicted to occur, not intergranular fracture, unless a symmetric double pileup occurs simultaneously. Absorption (or emission) of superpartials occurs only when the boundary region is disordered. Slip initiation from pre-existing sources near the boundary can occur under the local stress concentration. Implications of the present result on the inherent brittleness of grain boundaries in Ni_3 Al and its improvement by boron segregation are discussed.

49016 **Nucleation and amorphization of radiation-produced phases in a modified austenitic stainless steel during Ni-ion irradiation.** Lee, E.H.; Kenik, E.A. (Metals and Ceramics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6376). *Journal of Materials Research;* **3**: No. 5, 840-844(Sep 1988).

The nucleation and amorphization of radiation-induced (G) and radiation-enhanced (eta) phases in a silicon- and titanium-modified austenitic stainless steel have been studied under nickel-ion irradiation. These silicon- and nickel-enriched phases form under high-temperature (950 K) irradiation as the result of radiation-induced segregation to radiation-produced interstitial dislocation loops. Availability of carbon promotes the formation of eta phase relative to G phase. Under lower temperature (450 K) irradiation, G and eta phases are amorphized without significant change in composition of metallic elements. Two carbide phases (MC, $M_{23}C_6$) remain crystalline for the same irradiation conditions. The amorphization of the silicides may result from (1) radiation damage increasing their free energy above that of the amorphous state or (2) direct formation of the amorphous phase in the damage cascade.

49017 **(RFP-Trans—477) A method for improving the depth of penetration and the appearance of welding.** Moisio, Tapani. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Jul 1988. Contract AC04-76DP03533. Translation of Finish Patent No. 64063. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012954/JAW.

This invention relates to gas-shielded arc welding of high-alloy steel. With this method, the form, surface tension and particularly the depth of penetration and welding speed can be improved. This invention is based on the observation that when welding high-alloy steel, the presence of oxides as a layer of a certain thickness in the area of the welding affects the arc-welding flame. In gas-shielded arc welding, the arc flame is concentrated, and thus its energy flux is aimed at a smaller area, which in turn leads to a deeped penetration. thus both the depth of fusion and the welding rate improve. This phenomenon is present even more when welding difficult-to-weld batches, but is also clear significant in easily weldable batches. This leads to a leveling out of weldability differences. 1 tab.

49018 **The relation between the structure and mechanical properties of a $\Sigma = 51$ tilt boundary in germanium.** Skrotzki, W.; Wendt, H.; Carter, C.B.; Kohlstedt, D.L. (Institut fur Geologie und Dynamic der Lithosphare, Universitat Gottingen, Goldschmidt Str. 3, 3400 Gottingen (DE)). *Acta Metallurgica;* **36**: No. 4, 983-994(Apr 1988).

A series of Germanium bicrystals containing a 16° [011] tilt boundary has been deformed in high-temperature creep and analyzed by high-resolution lattice-fringe imaging and conventional transmission electron microscopy. Before deformation, the structure of the boundary consists of a linear array of Lomer dislocations. Subgrain boundaries are produced by the deformation and intersect the original grain boundary. Absorption of lattice-dislocations causes the interfacial structure to change along the boundary from one subgrain to another. Deviations from the $\Sigma = 51$ coincidence structure are accommodated by secondary dislocations. The secondary dislocations have non-primitive DSC-Burgers vectors. Upon entering the grain boundary, the deformation-produced lattice dislocations decompose into secondary dislocations. Their motion in the interface is associated with grain boundary migration and grain boundary sliding. However, the latter process could not be identified macroscopically and, therefore, appears to make a much smaller contribution to the total strain than it does in metals. It is also directly shown that screw dislocations with Burgers vector in direction of the tilt axis can pass through the boundary.

49019 **Plastic deformation in nonstoichiometric UO/sub 2+x/ single crystals - I. Deformation at low temperatures.** Keller, R.J.; Mitchell, T.E.; Heuer, A.H. (Precision Castparts Corp., Cleveland, OH (US)). *Acta Metallurgica;* **36**: No. 4, 1061-1071(Apr 1988).

Single crystals of UO/sub 2 + chi/ (5 x 10/sup -6/ ≦ chi ≦ 10/sup -2/) have been deformed in equilibrium CO/CO/sub 2/ mixtures at 873 K in compression and at 300 K under microhardness indents. The primary glide plane is {111} under all conditions. The yield stress is independent of chi at 873 K but increases slightly with increasing chi at 300 K. Dislocation substructures consists largely of screw dislocations, indicating that the motion of screw dislocations controls deformation. It is likely that dislocation mobility is controlled by interactions between dislocations and extrinsic defects.

49020 **Plastic deformation in nonstoichiometric UO/sub 2+x/ single crystals - II. Deformation at high temperatures.** Keller, R.J.; Mitchell, T.E.; Heuer, A.H. (Precision Castparts Corp., Cleveland, OH (US)). *Acta Metallurgica;* **36**: No. 4, 1073-1083(Apr 1988).

Single crystals of UO/sub 2+x/ (5 x 10/sup -6/ ≦ chi ≦ 10/sup -4/) have been deformed in equilibrium CO/CO/sub 2/ mixtures at 1073, 1273 and 1673 K in compression. The primary glide plane is dependent on orientation, temperature and extent of non-stoichiometry, such that [001]<110> glide is most common at low O/U ratios and high temperatures, while [111]<110> glide is prevalent at high O/U ratios and low temperatures. The critical resolved shear stress (CRSS) for [001] glide is nearly independent of

chi, while the CRSS for [111] glide decreases with increasing chi. At low values of chi, slip is controlled by interactions between dislocations and extrinsic defects the dislocation and defect mobilities are nearly equal (for the strain rates examined) at temperatures between 1350 and 1650 K. At high values of chi, the interactions between dislocations and extrinsic defects still play a major role in controlling dislocation motion; however, it appears that the presence of oxygen interstitial defect clusters serves to diminish the hardening effects of impurities for [111] glide. When deformed specimens with high values of chi are reduced to low values of chi, dislocations act as sinks for "exsolved" oxygen, resulting in increase in strength on further deformation.

49021 **The collapse of defect cascades to dislocation loops during self-ion irradiations of iron, nickel, and copper at 30, 300, and 600 K.** Kirk, M.A.; Robert, I.M.; Vetrano, J.S.; Jenkins, M.L.; Funk, L.L. (Materials Science Div., Argonne National Lab., Argonne, IL (US)). pp 48-59 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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The formation of the dislocation loops by self-ion irradiations of iron, nickel, and copper has been studied in situ in the Argonne National Laboratory (ANL) high-voltage electron microscope (HVEM) as functions of ion dose and irradiation temperature. At low doses (≦10/sup 12/ ions/cm/sup 2/) at room temperature individual cascades were observed to collapse to vacancy dislocation loops in copper with high probability, in nickel with lower probability, and in iron with zero probability. Cascade collapse was observed at low doses at 30 K in copper and nickel, but at rates less than their respective rates at room temperature. A loop formation rate for nickel at 600 K is also reported. At higher doses (>10/sup 13/ ions/cm/sup 2/) where overlap of cascades becomes significant, loops were first observed in iron and with a supra-linear buildup with dose. Also at higher doses a decrease in loop production rate in cooper and nickel was observed because of loop coalescence. The material and temperature dependence of cascade collapse probabilities is suggested to be related to thermal spike mechanisms during the cascade formation lifetime.

49022 **The collapse of defect cascades to dislocation loops in Cu/sub 3/Au.** Black, T.J.; Jenkins, M.L.; English, C.A.; Kirk, M.A. (Materials Science and Technology Div., Argonne National Lab., Argonne, IL (US)). pp 60-69 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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The authors report a systematic experimental study of the conditions leading to vacancy dislocation loop formation at the sites of defect cascades produced by ion irradiations. Transmission electron microscopy (TEM) techniques and the ordered alloy Cu/sub 3/Au were employed to measure the probability of dislocation loop formation as functions of irradiating ion mass (Ar/sup +/, Cu/sup +/, and Kr/sup +/), ion energy (50 and 100 keV), and sample irradiation temperature (30 and 300 K). Disordered zones in the ordered alloy were produced at eery defect cascade site and imaged in dark-field superlattice reflections. Dislocation loops were imaged in fundamental reflections in the same sample areas to produce a very accurate measurement for the probability of the collapse of each cascade to a dislocation loop, within a large set (—200) of defect cascades for each irradiation condition. The size distribution of dislocation loops and disordered zones were also measured for selected irradiation conditions. A central result was that defect cascades collapse to dislocation loops with significant probability (—0.5) even at sample irradiation temperatures of 30 K. Other observations include an increasing collapse probability with increasing cascade energy density (increasing ion mass) and with increasing sample irradiation temperature. However no additional collapse was observed upon annealing from 30 to 300 K, and no increase in collapse probability was observed upon increasing the bombarding ion energy from 50 to 100 keV. Disordered zone sizes also increased with increasing ion mass and with increasing sample irradiation temperature (30 to 300 K).

49023 **Quantitative study by field ion microscopy of radiation damage in tungsten after proton and neutron irradiation.** Farnum, D.J.; Sommer, W.F.; Inal, O.T.; Yu, J. (New Mexico Institute of Mining and Technology, Socorro, NM (US)). pp 90-100 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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The defects that result from proton and neutron irradiation of tungsten were studied using a field ion microscope. The initial stages of radiation damage can be examined by noting the configuration, density, and type of defect. This study used medium-energy protons as well as a spallation neutron flux for the irradiation. Annealed tungsten was examined in the field ion microscopy in both an unirradiated and irradiated condition. Irradiations were conducted using protons and spallation neutrons at the Los Alamos Meson Physics Facility (LAMPF). Temperature was controlled in the proton irradiations (by water cooling) to less than 323K. The temperature for the neutron irradiations was measured at 398 K. The concentration for vacancies that survived recombination and were observed with the field ion microscope were 1 to 3% of the calculated displacements per atom (dpa). The remainder are suspected to have undergone vacancy-interstitial recombination resulting from a fluence of 10/sup 22/ and 10/sup 24/ protons per square metre was observed to be 2.5 x 10/sup -3/ and 8 x 10/sup -3/, respectively. The neutron-irradiated samples contained a vacancy concentration of 4 x 10/sup -3/ after a fluence of 10/sup 23/ neutrons per square metre. Depleted zones containing 1000 or more vacant lattice sites along with smaller zones containing from 30 to 300 vacant lattice sites were observed in the irradiated material.

49024 **Irradiation-induced swelling in AISI 316 steel: Effect of tensile and compressive stresses.** Lauritzen, T.; Vaidyanathan, S.; Bell, W.L.; Yang, W.J.S. (Lawrence Livermore National Lab., Livermore, CA (US)). pp 101-113 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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Effects of bending stresses on the swelling behavior of 20% cold worked AISI 316 steel were studied in material irradiated to moderately high fluences in EBR-II. Specimens used in this investigation consisted of beams subjected to four-point bending during irradiation. Fluences as high as 1.5 x 10/sup 23/ n/cm/sup 2/ (E > 0.1MeV) were accumulated at temperatures ranging from 412 to 458°C. The beams were subsequently sectioned to isolate regions of tensile, compressive, and neutral loading for examination by transmission electron microscopy. A complete characterization of swelling in each of the three regions was conducted to assess the influence of these stress states on the magnitude of swelling. A detailed microstructural evaluation of the material was also made to attempt to relate swelling differences with physical changes in the alloy. The results of this investigation confirm earlier experimental data that showed swelling in AISI 316 steel to be enhanced by the application of stress during irradiation and that the magnitude of swelling is independent of the sign of the applied stress. The results also show that increases in swelling can be correlated with either more or larger voids depending upon the total strain incurred. This suggests that the mechanism for stress-enhanced swelling in this alloy may be a sensitive function of the magnitude of the applied stress.

49025 **Swelling of 316 stainless steel and D9 cladding in FFTF.** Makenas, B.J. (Westinghouse Hanford Co., P.O. Box 1970, Richland, WA (US)). pp 146-153 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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A data base of cladding swelling measurements from post-irradiation examinations of Fast Flux Test Facility (FFTF) 316 stainless steel clad fuel pins has been developed, which is now sufficiently large to compare to previously published cladding swelling data. This comparison of data was motivated by the observation, in the early cycles of FFTF operation, that design swelling correlations had to be adjusted to account for the observed length increases for driver assembly ducts. These original correlations had been developed from nonfueled EBR-II irradiation tests. The recent data indicate that FFTF and EBR-II cladding, from actual fuel pins with similar heats of steel, behave almost identically with respect to fast fluence. The FFTF data further suggest that, above ~490°C, 316 stainless steel (SS) swells in a manner that is essentially independent of irradiation temperature. A comparison of immersion density measurements with the length increases the FFTF driver fuel pins has also shown the 316 SS cladding swelling behavior to be essentially isotropic. D9 cladding (a titanium modified variant of 316 SS) has also been irradiated in FFTF. The data base here is limited but is large enough to establish the superiority of D9 over 316 SS as an FFTF fuel pin cladding from a swelling point of view.

49026 **Neutron-induced swelling of Fe-Mn and Fe-Cr-Mn austenitic alloys.** Garner, F.A.; Brager, H.R. (Westinghouse Hanford Co., P.O. Box 1970, W/A-58, Richland, WA (US)). pp 195-206 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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An effort is underway to explore the potential of Fe-Cr-Mn austenitic alloys as substitutes for Fe-Cr-Ni alloys in fusion reactors. This substitution is desired to achieve a reduced level of long-term radioactivity and thereby reduce the cost and safety hazards associated with disposal of reactor components at their end of life. Neutron-induced swelling data to 50 dpa are now available at 520°C for three reduced activation alloy series and for lower exposures at 420 and 600°C. These three series cover simple binary and ternary alloys, solute-modified ternaries, and a variety of commercially available Fe-Cr-Mn alloys. The swelling of these alloys is initially similar to that of Fe-Cr-Ni alloys but then changes in response to phase instabilities that develop in the Fe-Cr-Mn system.

49027 **Neutron-induced swelling in cold-worked titanium-modified AISI 316 alloys.** Puigh, R.J.; Garner, F.A. (Westinghouse Hanford Co., P.O. Box 1970, W/A-57, Richland, WA (US)). pp 154-160 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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In an earlier experiment it was shown that titanium additions related to suppress swelling of American Iron and Steel Institute (AISI) 316 alloys in the annealed condition. Evidence is presented to show that a similar effect occurs in the cold-worked conditions in both the Experimental Breeder Reactor (EBR-II0 and the Fast Flux Test Facility (FFTF). The titanium-modified steels owe their improved swelling resistance not only to their titanium additions but also to small but significant changes in nickel, chromium, silicon and phosphorous levels.

49028 **Void-precipitate association during neutron irradiation of austenitic stainless steel.** Pedraza, D.F.; Maziasz, P.J. (Metals and Ceramics Div., Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN (US)). pp 161-194 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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Microstructural data have recently become available on a single heat of 316 stainless steel irradiated in EBR-II and HFIR, over a wide range of irradiation temperatures (55 to 750°C), doses (7 to 75 dpa), and several helium generation rates (0.5 to 55 atomic ppm He/dpa). Results on just one heat of steel minimize effects that may be related to compositional differences. In this work the authors present these data in order to offer a characterization of precipitate-void association within the context of the overall microstructural evolution. Observations on a second heat of steel are also presented here to allow us to assess which microstructural correlations are general. The analysis of experimental results leads us, first, to conclude that precipitate-void association is not only dependent upon local conditions at the precipitate interface but is also strongly related to the overall microstructural evolution. Second, they suggest a precipitation mechanism that helps to understand precipitate-void codevelopment.

49029 **The effect of swelling in Inconel 600 on the performance of FFTF reflector assemblies.** Makenas, B.J.; Trenchard, R.G.; Hecht, S.L.; McCarthy, J.M.; Garner, F.A. (Hanford Engineering Development Lab., P.O. Box 1970, Richland, WA (US)). pp 207-219 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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The fast flux test facility (FFTF) is designed with nonfueled outer row assemblies, each of which consists of a stack of Inconel 600 blocks penetrated by 316 stainless steel (SS) coolant tubes. These assemblies act as a radial neutron reflector and as a straight but flexible core boundary. During an FFTF refueling outage, it was observed that the degree of difficulty in withdrawing an outer row driver fuel assembly was a function of the peak fast fluence of neighboring reflector assemblies. It was subsequently determined through various postirradiation examinations that the reflector assemblies were both bowed and stiff. Measurements of the individual Inconel 600 blocks indicated that the blocks had distorted into a trapezoidal cross section because of differential swelling of Inconel 600 in a steep radial flux gradient. Immersion density results indicate greater irradiation induced volumetric swelling than any previously reported data or correlation for Inconel 600 at equivalent fast fluence. The Inconel 600 swelled approximately the same amount as the SA 316 SS reflector components. Transmission electron microscopy studies on the Inconel blocks and swelling measurements on related material have been performed, and these data have been related to the performance of the reflector materials.

49030 **The behavior of solute segregation and void formation in Fe-Cr-Ni and Fe-Cr-Mn steels during electron irradiation.** Takahashi, H.; Garner, F.A.; Itoh, H.; Hu, B.; Ohnuki, S. (Hanford Engineering Development Lab., Richland, WA (US)). pp 268-278 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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The relative swelling behavior of Fe-Cr-Mn and Fe-Cr-Ni alloys during electron irradiation is shown to be different from that observed in neutron irradiations. This difference appears to be a consequence of the different diffusion behavior of nickel and manganese in response to the operation of the inverse Kirkendall effect. The vacancy gradients driving the diffusion in these experiments are generated not only by the foil surfaces and the electron-generated radial displacement gradient but also by high angle grain boundaries deliberately centered in the middle of the electron beam. This procedure allows the relative diffusional characteristics of each element to be observed by energy-dispersive X-ray (EDX) measurements across the grain boundary. The influence of helium and minor solutes on swelling was also studied in these experiments and yielded no behavior atypical of that observed in neutron irradiation studies.

49031 **Oxygen effects on void stabilization in stainless steel.** Seitzman, L.E.; Kulcinski, G.L.; Dodd, R.A. (Fusion Technology Institute, Dept. of Nuclear Engineering, Univ. of Wisconsin, Madison, WI (US)). pp 279-285 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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Void nucleation theories often require surface energies significantly lower than established values in order to properly model cavity formation in metals. Surface impurities can cause the necessary decrease in surface energy and oxygen, which can interact readily with surfaces, is an abundant impurity in many metals. This study indicates that oxygen is especially effective in stabilizing voids. The amount of oxygen necessary to stabilize void formation in ion-irradiated Type 316 stainless steel is calculated as a function of temperature. Voids can be stabilized by reducing the surface energy such that the void becomes the most energetically stable vacancy cluster defect up to a size of 100 vacancies (D = 1.3 nm in steel). In austenitic steel, voids are stabilized when the surface energy decreases from 2.2 to 1.0 J/m/sup 2/. This level of reduction in surface energy could be accomplished by the chemisorption of oxygen, initially in solution, on void embryos that are formed in the early stages of irradiation. Calculations for a Type 326 stainless steel reveal that the required amount of free oxygen initially in solution to nucleate voids is a minimum of 4 appm at 550°C.

49032 **The influence of both major and minor element composition on void swelling in austenitic steels.** Garner, F.A.; Kumar, A.S. (Westinghouse Hanford Co., Hanford Engineering Development Lab., Richland, WA (US)). pp 289-314 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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Data on the neutron-induced swelling of simple Fe-Ni-Cr austenitic alloys are presented to show that there are three compositional regimes of swelling as a function of nickel content. The intermediate transition regime can be shifted to higher or lower nickel levels as a function of chromium content, various solutes, displacement rate, temperature, and helium level. Such shifts can preclude the observation of either the lower or upper nickel regime. The lower nickel regime is also obscured in ion bombardment studies because of factors that are atypical of the neutron environment. Data are also presented to show the influence of silicon and phosphorus on the neutron-induced swelling of Fe-25Ni-15Cr and to demonstrate that the separate influence of each of these elements is more complex than previously observed. Similar complex trends have also been seen in ion bombardment experiments, but there are additional distortions relative to the neutron-induced behavior that arise from the interaction of these elements with point defect gradients. A model is presented to show that the major effect of composition on swelling lies in its influence on void nucleation, operating primarily on the intermediate transition regime. Compositional variations thus appear as a "temperature shift" analogous to that associated with changes in displacement rate. This shift is due to the effect of each element on the vacancy supersaturation via their effect on either the equilibrium vacancy concentration or the effective vacancy diffusion coefficient.

49033 **Effect of nickel content on the minimum critical void radius in ternary austenitic alloys.** Coghlan, W.A.; Garner, F.A. (Westinghouse Hanford Co., Richland, WA (US)). pp 315-329 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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Swelling data from both ion and neutron irradiations of Fe-Cr-Ni alloys are analyzed in terms of the critical radius concept for bubble-to-void conversion. It is shown that while the dependence of critical radius on temperature, displacement rate, and helium can explain many features of the data, one must also consider the dependence of vacancy diffusion on nickel content in order to be able to explain the compositional dependence of void nucleation.

49034 **A comparison of the relative importance of helium and vacancy accumulation in void nucleation.** Stoller, R.E.; Odette, G.R. (Metals and Ceramics Div., Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN (US)). pp 358-370 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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Void nucleation in irradiated austenitic stainless steels generally requires the presence of either residual or transmutant gases. Classical nucleation rates are much too low to account for the number of voids observed at temperatures greater than about 450°C. An alternate path is generally believed to be responsible for void formation; namely, the growth of gas-stabilized bubbles until they reach a critical size beyond which further gas accumulation is not required to promote growth. Two limiting paths can be envisioned for void nucleation on a population of sub-critical helium/vacancy clusters; one is limited to growth by helium accumulation alone and the other to growth by stochastic fluctuations in the vacancy accumulation. As ubbles approach the critical size, stochastic processes could begin to contribute to the void nucleation rate. A comparison is made of nucleation rates along these two limiting paths as a function of the gas content of the clusters. The calculations indicate that the gas accumulation path is generally dominant, particularly at higher temperatures and for lower gas contents. The fraction of the critical size required for the vacancy path to contribute to the total nucleation rate increases with temperature. The results confirm the important role of transmutant helium in promoting void swelling.

49035 **A composite model of microstructural evolution in austenitic stainless steel under fast neutron irradiation.** Stoller, R.E.; Odette, G.R. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp 371-392 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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A rate-theory-based model has been developed which includes the simultaneous evolution of the dislocation and cavity components of the microstructure of irradiated austenitic stainless steels. Previous work has generally focused on developing models for void swelling while neglecting the time dependence of the dislocation structure. These models have broadened our understanding of the physical processes that give rise to swelling, for example, the role of helium and void formation from critically-sized bubbles. That work has also demonstrated some predictive capability by successful calibration to fit the results of fast reactor swelling data. However, considerable uncertainty about the values of key parameters in these models limits their usefulness as predictive tools. Hence, the use of such models to extrapolate fission reactor swelling data to fusion reactor conditions is compromised. The present work represents an effort to remove some of these uncertainties by self-consistently generating the time dependence of the dislocation structure, both faulted loops and network dislocations. The model's predictions reveal the closely coupled nature of the evolution of the various microstructural components and generally track the available fast reactor data in the temperature range of 350 to 700°C for doses up to 100 dpa. As the theoretical model has become more complex, parameter choices were constrained to a more limited range of values in order to obtain this agreement between theory and experiment. While the model remains approximate in many respects, it should ultimately provide a more useful tool for understanding microstructural evolution under irradiation and permit more confident predictions of void swelling in future fusion reactors.

49036 **Comparison of various sink strengths for analyzing radiation creep, growth, and swelling.** Nichols, F.A.; Liu, Y.Y. (Argonne National Lab., Building 212, 9700 South Cass Ave., Argonne, IL (US)). pp 414-431 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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The essential physics involved in the reaction-rate-theory analysis of radiation effects at temperatures where both vacancies and self interstitials are mobile is contained in the expressions used for the strengths of distributed point-defect sinks such as dislocations, cavities, and grain boundaries. These sink strengths have been obtained by various authors in distinctly different ways, thus giving rise to some possible confusion in comparing the various results. This is even more true with respect to the effect of interaction fields on these sink strengths, and the so-called bias factors or sink efficiencies have been defined in entirely different ways, thus rendering quantitative comparisons difficult. The authors present here a comparison of several procedures in the literature and attempt to make reasonable quantitative comparisons.

49037 **Dislocation evolution in Fe-10% Cr.** Horton, L.L.; Bentley, J. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp 466-477 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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The dislocation microstructure found in the binary ferritic alloy, Fe-10% Cr, has been characterized for damage levels ranging from 0.3 to 100 dpa. The specimens were irradiated at 850 K with a "triple beam" of He/sup +/, D/sup +/,and 4 MeV Fe/sup ++/ ions. Transmission electron microscopy revealed that dislocation loops were dominant in the dislocation microstructure from 0.3 to 3 dpa. At 0.3 dpa the loops were round to slightly rectilinear in shape, whereas at higher doses the majority of the loops had a convoluted shape that indicated preferential growth in the [110] directions. Analyses showed that all of the loops at low doses and the convoluted loops at 3 dpa were near-edge interstitial loops with b = a[100]. AT 3 dpa, round intersitial loops with b = a/2[111] were also observed. Network segments with b = a/2[111] were found at the intersection of a[100] loops with a/2[111] loops. At damage levels greater than 10 dpa, the structure consisted of a coarse distribution of network segments along with a few loops with b = a/2[111]. At 30 and 100 dpa a relatively low dislocation density, <10/sup 14/ m/sup -2/, was found. The effects of segregation on the observed dislocations and the implications of the observations on the current understanding of dislocation evolution and damage mechanisms in ferritic materials are discussed.

49038 **Microstructural changes in commercial aluminum alloys caused by irradiation with 800-MeV protons.** Singh, B.N.; Lohmann, W.; Ribbens, A.; Sommer, W.F. (Los Alamos National Lab., Los Alamos, NM (US)). pp 508-519 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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Commercial Al-Mg ad Al-Mg-Si alloys were irradiated in the Los Alamos Meson Physics Facility (LAMPF) with 800-MeV protons. The irradiation experiment was carried out at a temperature between 40 to 100°C to a dose level of ≦0.2 dpa. Post-irradiation microstructure and mechanical properties of these alloys have been investigated. For comparison, a parallel investigation was conducted on unirradiated reference specimens as well as on unirradiated annealed (981 h at 100°C, corresponding to time at temperature during irradiation) specimens. It was found that the cold-work microstructure in the Al-Mg alloy survives the thermal annealing treatment but dissolves during irradiation already at a dose level of ≦0.1 dpa. In the Al-Mg-Si alloy magnesium silicide (Mg/sub 2/Si) type precipitates also survive the thermal annealing but dissolve during irradiation at a low dose level of ≦0.1 dpa. Post-irradiation mechanical testing demonstrated that the strength of these alloys is drastically reduced because of irradiation. The observed irradiation softening can be understood in terms of the observed microstructural changes caused by irradiation.

49039 **Ion damage in a Fe-10Cr-6Mo-0.5Nb ferritic steel.** Farrell, K.; Lee, E.H. (Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN (US)). pp 498-507 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

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An annealed-and-aged ferritic steel containing fine NbC precipitates and relatively coarse particles of Laves phase was bombarded with 4-MeV iron ions to 100 displacements per atom (dpa) at 400 to 600°C. Much of the damage structure consisted of dislocation tangles that coarsened with increasing temperature. Cavity formation began at 450°C, peaked at about 535°C,a nd was absent at 600°C. Maximum swelling was only 0.2%. The Laves particles exhibited recoil dissolution and restructuring. Bombardments with Fe + He + D or Fe + He beams at ratios of 10 atomic parts per million (appm) He/dpa and 45 appm D/dpa introduced high concentrations of very small bubbles and comparatively few larger, bias-driven cavities. The latter were initiated at bubble clusters on NbC particles. Maximum swelling of 0.75% occurred at 550°C. Recoil dissolution of the Laves phase was retarded by the gases. Large critical cavity sizes and unbalanced dislocation and cavity sink strengths contribute to low swelling of this alloy.

49040 **Effects of heavy-ion irradiation on HT-9 ferritic steel examined in cross section.** Kai, J.J.; Kulcinski, G.L.; Dodd, R.A. (Fusion Technology Institute, Nuclear Engineering Dept., Univ. of Wisconsin, Madison, WI (US)). pp 530-544 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

Specimens of HT-9 have been irradiated with 14 MeV Ni/sup +3/ ions in the temperature range from 300 to 600°C and up to the peak damage level of 200 dpa. The specimens were prepared for transmission electron microscopy (TEM) studies using the cross-section technique that allows the whole damage region to be examined in a single foil. The most significant result of this study is that without prior implantation of helium gas atoms virtually no cavities were found in any of the irradiated specimens. Other microstructural features resulting from the irradiation were also examined in detail, including dislocation loops and precipitates. After irradiation at 300°C, the microstructure consisted of a very high number density of small dislocation loops. The average diameter of these loops is 8 nm and is relatively independent of the dose level. The number density of the loops saturates at higher dose levels. The microstructure after irradiation at 400°C is very similar to the 300°C case except that the average diameter of the dislocation loops is about 24 nm. However, a new phase forms at the end of the damage range during the irradiation at 400°C. The particle diameter of this new phase is about 5 nm, and it has been provisionally as α′ phase, which is a chromium enriched bcc phase. It forms largely in association with the dislocation loops. After irradiation at 500°C, the microstructure consisted of a few large dislocation loops, dislocation segments, and a group of new precipitates. The dislocation loops have the same characteristics as in the 300 and 400°C cases. The size of the loops is independent of dose level and about 100 nm in diameter, and the number density of the loops saturates at higher dose levels. The new phase has been identified as the Chi phase, which is an intermetallic phase with a bcc structure.

49041 **Microstructural examination of 12% Cr martensitic stainless steel after irradiation at elevated temperatures in FFTF.** Hsu, C.Y.; Gelles, D.S.; Lechtenberg, T.A. (Fusion Materials, Westinghouse Hanford Co., P.O. Box 1970, Richland, WA (US)). pp 545-559 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

A remelted 12% Cr martensitic stainless steel (HT-9) has been examined by transmission electron microscopy before and after irradiation in the Materials Open Test Assembly (MOTA) of the Fast Flux Test Facility (FFTF). The irradiation temperatures were 365, 420, 520, and 600°C with the fluences as high as 7.3 x 10/sup 22/ n/cm/sup 2/ (E > 0.1 MeV) or 34 dpa. The extracted precipitates from each specimen were identified using X-ray microanalysis and selected area diffraction. The precipitates in the unirradiated condition were primarily M/sub 23/C/sub 6/ carbides, which formed at martensite lath and prior austenite grain boundaries. During irradiation at elevated temperatures, small amounts of other phases formed, which were tentatively identified as the chromium-rich α', the nickel-silicon rich G-phase, and the intermetallic Chi phase. Irradiation-induced voids were observed only in specimens irradiated at 420°C to a dose of 34 dpa; no voids were found for specimens irradiated at 365, 520, and 600°C (—11, —34, and — 34 dpa). These results are not in agreement with previous experiments in that voids have not been reported in this alloy at relatively high fluence level (—67 dpa) following irradiation in another fast-spectrum reactor (EBR.II). This is, however, the first observation following FFTF irradiation. The present results indicate that cavities can form in HT-9 modest fluence levels even without significant generation of helium. Hence, the cavity formation in this class of ferritic alloys is not simply caused by helium generation but rather more complex mechanisms.

49042 **Evaluation of ferritic alloy Fe-2 1/4Cr-1Mo after neutron irradiation: Microstructural development.** Gelles, D.S. (Pacific Northwestern Lab., 326 Building, 300 Area, P.O. Box 999, Richland, WA (US)). pp 560-587 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

As part of a program to provide a data base on the bainitic alloy Fe-2 1/4Cr-1Mo for fusion energy applications, microstructural examinations are reported for nine specimen conditions for 2 1/4Cr-1Mo steel that had been irradiated by fast neutrons over the temperature range 390 to 510°C. Void swelling is found following irradiation at 400 to 480°C. Concurrently dislocation structure and precipitation developed. Peak void swelling, void density, dislocation density, and precipitate number density formed at the lowest temperature, approximately 400°C, whereas mean void size and mean precipitate size increased with increasing irradiation temperature. The examination results are used to provide interpretation of in-reactor creep, density change, and post irradiation tensile behavior.

49043 **The fine scale microstructure in cast and aged duplex stainless steels investigated by small angle neutron scattering.** Epperson, J.E.; Lin, J.S.; Spooner, S.S. (Materials Science Div., Argonne National Lab., Argonne, IL (US)). pp 595-616 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

Small angle neutron scattering (SANS) allows clustering phenomena to be studied in systems for which the constituent atoms do not differ greatly in atomic number. This investigation used SANS to characterize the fine scale microstructure in two cast and aged duplex stainless steels that are used in the nuclear industry; aging times extended up to eight years. The steels differed in ferrite content by about a factor of two. The intensity at the lowest scattering angle was dominated by scattering effects that were largely removed by applying a 4-kilogauss magnetic field and is, therefore, associated with the ferrite phase. In the range of momentum transfer 0.025 ≦ q ≦ 0.2 A/sup -1/, additional scattering caused by a precipitate phase, assumed to be rich in nickel and silicon, was observed. This scattering was rather intense, and the volume fraction of precipitate, in the ferrite, was estimated to be 12 to 18% after long time aging. After 70,000 h at 400°C, there were about 10/sup 24/ precipitate particles per m/sup 3/, some 50 A in mean diameter, and they were distributed in a nonrandom manner, that is, spatially, short-range ordered. This investigation suggests that after aging some 70,000 h at 400°C, the precipitate in the ferrite phase is undergoing ripening or coarsening. The present data are insufficient to indicate at what time this ripening process began.

49044 **Radiation-induced segregation in light-ion bombarded Ni-8% Si.** Packan, N.; Heatherly, L.; Kesternich, W.; Schroeder, H. (Metals and Ceramics Div., Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN (US)). pp 617-627 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

Radiation-induced segregation (RIS) is an important area of current research because of potential detrimental effects including embrittlement. In this work, a quantitative assessment is made of radiation-induced silicon segregation to internal grain boundaries compared with that to the external surfaces. Tension specimens of Ni-8 atomic % Si have been irradiated at 750 K (475°C) with either 7-MeV protons or 28-MeV alpha particles to damage levels of 0.1 to 0.3 dpa. Postirradiation tension testing at 300, 720 or 975 K produces ductile failures with elongations >15%. However specimens that had implantation of 250 to 1000 atomic ppm He at 975 K (700°C) before irradiation did fracture intergranularly when pulled at 975 K inside a scanning Auger microprobe, thereby exposing grain boundary surfaces for depth profile analysis. After correction for preferential sputtering effects, RIS of silicon to outer surfaces is found to give rise to a strongly enriched surface layer, 20 to 30 nm thick, followed by a shallow depletion zone for the next —200nm, in agreement with previous studies in the literature. By contrast, silicon segregation to fracture-exposed grain faces varies considerably from face to face but generally declines more gradually with little or no depletion zone. Observations of silicon profiles and Ni/sub 3/ Si formation at grain boundaries obtained by analytical transmission electron microscopy (TEM) generally confirm the Auger results.

49045 **Phase transformations in neutron-irradiated zircaloys.** Chung, H.M. (Argonne National Lab., Material Science and Technology Div., 9700 S. Cass Ave., Argonne, IL (US)). pp 676-699 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

Microstructural evolution in Zircaloy-2 and -4 spent-fuel cladding specimens after three years of irradiation in commercial power reactors has been investigated by transmission and high-voltage electron microscopies. Two kinds of precipitates induced by the fast-neutron irradiation in the reactors have been identified, that is, Zr/sub 3/O and cubic-ZrO/sub 2/ particles approximately 2 to 10 nm in size. By means of specimen tilting and dark-field stereomicroscopy, the bulk nature of the cubic-ZrO/sub 2/ particles has been shown. The Zr(Fe/sub x/, Cr/sub 1-x/)/sub 2/ and Zr/sub 2/ (Fe/sub x/, Ni/sub 1-x/) intermetallic precipitates normally present in the as-fabricated material virtually dissolved in the spent-fuel cladding specimens after a fast-neutron fluence of —4 x 10/sup 21/ n/cm/sup 2/ in the power reactors. The observed radiation-induced phase transformations are discussed in relation with the currently available understanding of the alloy characteristics.

49046 **Radiation-induced segregation in Cu-Au alloys.** Hashimoto, T.; Rehn, L.E.; Okamoto, P.R. (Materials Science Div., Argonne National Lab., Argonne, IL (US)). pp 700-712 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

Radiation-induced segregation in a Cu-lat.% Au alloy was investigated using in-situ Rutherford backscattering spectrometry. Irradiation with 1.8-MeV helium produced nonequilibrium gold atom depletion in the near surface region. The amount of segregation was measured as a function of dose, dose rate, and temperature. Segregation was observed in the temperature range between about 300 and 500°C. For a calculated dose rate of 3.9 x 10/sup -5/ dpa/s, the radiation-induced segregation rate peaked near 400°C. Theoretical analysis based on the Johnson-Lam model predicted that the amount of segregation would be directly proportional to dose at the early stage of irradiation, would deviate from linearity with a continuously decreasing slope of intermediate doses, and finally approach a constant value after high doses. The analysis also predicted that the segregation rate would vary as the - 1/4th power of the dose rate at constant dose in the low temperature region. These predictions were all verified experimentally. A procedure for extracting relative defect production efficiencies from similar measurements is discussed.

49047 **Effect of irradiation on carbide evolution in a pure Fe-2 1/4Cr-1Mo ferritic alloy.** Brimhall, J.L.; Simonen, E.P. (Battelle-Northwest, P.O. Box 999, Richland, WA (US)). pp 713-720 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

Ion irradiation was observed to accelerate the kinetics of the carbide evolution in a "pure" Fe-2 1/4Cr-1Mo steel. The type and structure of the phases were unchanged by irradiation compared to thermal annealing. The transformation kinetics of Fe/sub 3/C to M/sub 7/C/sub 3/ and the independent nucleation of Mo/sub 2/C were both enhanced by the ion irradiation. The observed irradiation enhancement of the kinetics however did not follow a predicted trend based on a simple radiation enhanced diffusion model. There is no obvious explanation of this discrepancy except that mechanisms in addition to enhanced diffusion influence the complex transformation process.

49048 **Radiation-induced segregation and precipitation in molybdenum-rhenium alloys.** Erck, R.A.; Wayman, C.M.; Rehn, L.E. (Materials Science Div., Argonne National Lab., MSD-212, 9700 S. Cass Ave., Argonne, IL (US)). pp 721-729 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

Specimens of Mo-7 atomic % Re, Mo-27 atomic % Re, and Mo-30 atomic % Re were irradiated with 1.8-MeV /sup 4/He/sup +/ ions at elevated temperatures. Radiation-induced segregation of rhenium was measured during irradiation by in-situ Rutherford backscattering spectrometry (RBS). Segregation of the undersized rhenium atoms in the same direction as the defect fluxes, that is, toward the external surface, was observed. The amount of rhenium enrichment in the near-surface region was measured as a function of temperature and of dose at a calculated near-surface displacement rate near 1 x 10/sup -4/ dpa/s. Segregation was measured by RBS at temperatures from 800 to 1500°C in Mo-7Re, and from 850 to 1225°C in Mo-30Re. Irradiated disks were examined by transmission electron microscopy. Chi phase precipitation was observed on grain boundaries, and at the irradiated surface in Mo-27Re and Mo-30Re after irradiation at temperatures from 750 to 1075°C. Chi precipitates formed with cube/cube and twin orientations with respect to the host matrix. No voids or loops were observed for ion doses up to 1.6 dpa.

49049 **Solute segregation and microstructural evolution in ion-irradiated vanadium-base alloys.** Loomis, B.A.; Kestel, B.J.; Gerber, S.B. (Materials Science and Technology Div., Argonne National Lab., Argonne, IL (US)). pp 730-742 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

The microstructural evolution in V + 14.7 Cr, V + 2.5 Mo, V + 2.5 W, V + 8.0 Ni, V + 5.3 Ti, V + 14.7 Cr + 5.2 Ti, V + 9.6 Cr + 3.1 Fe + 0.7 Zr, and V + 3.2 Ti + 1.8 Si alloys (concentrations in atomic percent), and unalloyed V was determined from observations of specimens by transmission microscopy (TEM) following 4.0-MeV /sup 51/V/sup ++/ ion irradiation at 900 to 970 K to 50 dpa. The irradiation-induced segregation (RIS) of solutes in the ion-irradiated alloys was investigated by auger electron spectroscopy (AES), energy-dispersive X-ray spectroscopy (EDXS), and electron energy loss spectroscopy (EELS) analyses. The RIS of solutes and microstructural evolution in the irradiated alloys were correlated with the solute diffusivity and the relative chemical affinity of the substitutional solutes for oxygen.

49050 **Compositional redistribution in Fe-Ni-Cr alloys under proton irradiation.** Kimoto, T.; Shiraishi, H. (Nuclear Materials Div., Tsukuba Labs., National Research Institute for Metals, 1-2-1 Sengen, Sakura-mura, Niihari-gun, Ibaraki 305 (JP)). pp 748-757 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

The compositional redistribution in the direction of depth in austenitic Fe-Ni-Cr-Si-C alloys under 200-keV proton irradiation was examined experimentally using the cross-section technique. After the solution-annealed Fe-25.5Ni-14.7Cr-0.97Si-0.026C and Fe-25.7Ni-14.5Cr-2.85Si-0.026C alloys were irradiated at 873 K by 200-KeV protons to the dose of 175 dpa at the peak-damage position for the different irradiation times of 0.1 and 1.37 Ms, the depth profile of composition was measured with an energy dispersive X-ray microanalyzer. Significant depletion of nickel and enrichment of chromium were observed in the peak-damage region ranging from about 0.85 to 1.05 μm in depth, similarly in both the short-time (0.1 Ms) and long-time (1.37 Ms) irradiations. Slight enrichment of iron and slight depletion of silicon were also observed in the peak-damage region. The observed compositional changes in the peak-damage region is in good qualitative agreement with theoretical prediction, although some quantitative discrepancies between them remain.

49051 **Neutron-induced spinodal-like decomposition of Fe-Ni and Fe-Ni-Cr alloys.** Garner, F.A.; Brager, H.R.; McCarthy, J.M. (Westinghouse Hanford Co., Hanford Engineering Development Lab., Richland, WA (US)). pp 775-787 of Radiation-induced changes in microstructure: ASTM 13th international symposium (Part I). Garner, F.A.; Packan, N.H.; Kumar, A.S. Philadelphia, PA; ASTM (1987). (CONF-860605—).

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

Spinodal decomposition is not known to occur in the iron-rich regime of Fe-Ni and Fe-Ni-Cr fcc systems. During neutron irradiations conducted in the range 450 to 600°C, however, a spinodal-like separation occurs in the invar compositional range. Ion irradiation studies show a similar behavior and indicate that the separation process occurs as least as high as 725°C. The spinodal-like process is characterized by compositional microoscillations between —25 and —50% nickel with temperature-dependent wavelengths on the order of hundreds of nanometers. These oscillations exhibit a dependence on crystallographic orientation and cause significant hardening. Comparison of these oscillations with those produced in the Santa Catharina meteorite (Fe-35Ni) leads to the conclusion that Fe-Ni invar alloys decompose very slowly (many thousands of years) in the absence of radiation. During irradiation, the spinodal-

like decomposition and its subsequent coarsening are accelerated by enhanced diffusion and at lower irradiation temperatures by segregation of nickel via the inverse Kirkendall effect at radiation-produced sinks.

49052 **Order-disorder behavior of grain boundaries in a two dimensional model ordered alloy.** Farkas, D.; Jang, H. (Dept. of Materials Engineering, Virginia Polytechnic Institute, Blacksburg, VA (US)). pp 65-74 of High-temperature ordered intermetallic alloys II. Stoloff, N.S.; Koch, C.C.; Liu, C.T.; Izumi, O. Pittsburgh, PA; Materials Research Society (1987). (CONF-861207—).

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

The order-disorder behavior of a $\Sigma = 5$ grain boundary was investigated using a two dimensional lattice gas model and the cluster variation method. It is found that a disordered layer forms in the grain boundary regions at temperatures significantly below the order-disorder temperature for the bulk. Under certain assumptions for the pair interaction energies the model predicts grain boundary compositions different from the bulk.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 48249, 48415, 48940, 48941, 48941, 48999, 49002, 49096, 49103, 49105, 49127, 49173, 49209, 49323, 50035

49053 **(AD-A—193497/5/XAB) Low-temperature film growth of the oxides of zinc, aluminum, and vanadium (and related systems, oxides of gold and germanium, nitrides of aluminum and tungsten) by reactive sputter deposition. Final report, 1 July 1984-31 December 1987.** Aita, C.R. (Wisconsin Univ., Milwaukee (USA). Lab. of Surface Studies). Feb 1988. 140p. NTIS, PC A07/MF A01.

The research involved investigation of process-parameter growth environment film property relationships for various binary oxide and nitride films grown on unheated substrates by reactive sputter deposition using an elemental target. In-situ optical-emission spectroscopy and glow-discharge mass spectrometry were used to determine gas-phase species in the plasma volume. A battery of techniques were used to characterize (post-deposition) film crystallography, chemistry, microstructure, electrical resistivity, and optical behavior.

49054 **(AD-A—193944/6/XAB) Grazing-incidence x-ray study of the structures and phase transitions of hydrogen on tungsten (100).** Chung, J.W.; Evans-Lutterodt, K.; Specht, E.D.; Birgeneau, R.J.; Estrup, P.J. (Massachusetts Inst. of Tech., Cambridge (USA). Research Lab. of Electronics). 9 Nov 1987. 5p. NTIS, PC A02/MF A01.

Pub. in Physical Review Letters, Vol. 59, No. 19, 2192-2195(9 Nov 1987).

The paper reports a synchrotron x-ray diffraction study of the tungsten (100) surface reconstruction induced by the chemisorption of hydrogen at room temperature. The experiments verify previously deduced phase boundaries but they suggest a new interpretation of the phases, the most interesting being that the weakly incommensurate solid is actually a surface fluid. These experiments also illustrate the utility of x rays in obtaining quantitative intensity and line-shape information in chemisorbed surface systems.

49055 **(CONF-880705—8) Antiferromagnetic order of the Cu in RBa$_2$Cu$_3$O/sub 6+x/.** Lynn, J.W.; Li, W.H.; Mook, H.A.; Sales, B.C.; Fisk, Z. (Oak Ridge National Lab., TN (USA); Los Alamos National Lab., NM (USA)). 1988. Contract AC05-84OR21400;W-7405-ENG-48. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015553/JAW.

From International conference on magnetism; Paris, France (25 Jul 1988).

Neutron diffraction measurements have been taken on single crystals of RBa$_2$Cu$_3$O/sub 6+x/ (R = rare earth, or Nd) to explore the nature of the magnetic order as a function of oxygen concentration x. The Cu-O planes order antiferromagnetically at T/sub N1/, with T/sub N1/($x \sim$ O) {approximately} 450{degree}K. At lower temperatures the oxygen-deficient Cu planes also order magnetically, with a substantial low temperature moment ({approximately} 1/2 μ/sub B/) and a simple antiferromagnetic sequencing along the c-axis. Both ordering temperatures decrease with increasing x, with T/sub N2/ being much more sensitive to x than T/sub N1/. 6 refs., 2 figs.

49056 **(CONF-8805147—2) Ti-implanted optical waveguides in LiNbO$_3$.** Buchal, Ch.; Ashley, P.R.; Thomas, D.K. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015279/JAW.

From European Materials Research Society meeting; Strasbourg, France (31 May 1988).

$LiNbO_3$ is the best substrate for modulators and switches for integrated optics. Efficient low loss waveguides are fabricated by introducing Ti into the crystal. The maximum Ti concentration and the corresponding Δn as well as the minimum waveguide dimensions normally are limited by the diffusion characteristics. Ion implantation offers an interesting alternative, especially if infrared applications are intended. During the implantation process an amorphous non-equilibrium phase is generated, and subsequently the crystalline state has to be restored by solid phase epitaxy. This process results in guides with low losses of $<$ 1 db/cm. Fabrication details and guide characteristics are presented. 14 refs., 4 figs.

49057 **(DOE/ER/01198—T25) Investigation of a self-lubricating alumina coating formed by anodic spark deposition.** Koshkarian, K.A. (Illinois Univ., Urbana (USA)). 1988. Contract AC02-76ER01198. 148p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88014947/JAW.

Self-lubricating Al_2O_3 coatings were deposited with an incorporated second phase of MoS_2. The Al_2O_3 was predominantly α phase with small, varying amounts of γ and β forms. Amount of γ-Al_2O_3 was maximized in coatings deposited at 500 V. The coatings were porous and had variable adherence. The microstructure consisted of intersecting, highly stressed, elongated "sets" of similarly oriented grains with microcracks at the grain boundaries. Modulation was noted. The microstructure did not change with process parameters. The MoS_2 particles were more prevalent in porous, cracked regions. The largest amount of incorporation, found in coatings deposited in 5.0 g/l MoS_2 electrolyte, was on the order of 20–25 wt %. The coatings formed in 5.0 g/l MoS_2 electrolyte exhibited an approximately 50% lower wear rate. Only small amounts of MoO_3 were detected. As the first investigation into the process of producing self-lubricating Al_2O_3 coatings by anodic spark deposition, this study showed promise and also raised several areas for future work. 43 refs., 58 figs., 10 tabs.

49058 **(DOE/ER/01198—T26) Investigation of the lanthanide sesquioxides as high temperature transformation toughening agents.** Jero, P.D. (Illinois Univ., Urbana (USA). Graduate Coll.). 1988. Contract AC02-76ER01198. 239p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88014936/JAW.

The monoclinic to cubic (B to C) transformation in Gd_2O_3 and Tb_2O_3 was examined. This transformation involves an 8–10% volume expansion and a shape change (ΔB of {approximately}10{degree}. Gd_2O_3 and Tb_2O_3 exhibited different transformation behavior. Tb_2O_3 exhibited a rapid B to C transformation, whereas Gd_2O_3 remained in the B phase after high temperature processing; this probably results from different transformation mechanisms. I.e., the rapid B to C transformation in Tb_2O_3 at temperatures as low as 200{degree}C indicates that it can transform by a virtually diffusionless mechanism. The B to C transformation in Gd_2O_3 was not observed, except in a thin surface layer on roughly ground and annealed specimens. Pure Tb_2O_3 fired above 1700{degree}C shattered on cooling through the B to C transformation. Laser melting and roller quenching resulted in thin flakes of primarily B phase. Incorporation of the Tb_2O_3 into a matrix of MgO or $2Tb_2O_3${center←dot}Al_2O_3 allowed preparation of bulk specimens. Very rapid cooling was required to retain the Tb_2O_3 in the high temperature B form. Cooling rate was the dominant factor in retention of this form. Once retained in the B phase, the B to C transformation could not be induced in Tb_2O_3–MgO specimens at room temperature. Elevated temperatures were required to overcome the nucleation barrier to transformation. The B to C transfor-

mation was observed on the fracture surfaces of specimens broken at ≧1075{degree}C. Spontaneous transformation was observed on roughly ground surfaces at 1300{degree}C, and in the bulk at 1400{degree}C. In Tb_2O_3--Al_2O_3 specimens, transformation on fracture surfaces was observed at 1150{degree}C and spontaneous surface and bulk transformation at 1300{degree}C.

49059 (DOE/ER/45115—4) Fundamental aspects of erosion and impact damage: Progress report, January 31, 1987--January 31, 1988. Scattergood, R.O. (North Carolina State Univ., Raleigh (USA). Dept. of Materials Science and Engineering). 1988. Contract FG05-84ER45115. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88014726/JAW.

Progress is described in the following areas of research: indentation fracture and its adoption to erosion; erosion and crack propagation in glass; erosion of fiber-reinforced Al-4% Cu composites; fracture mechanics analysis of lateral cracks; and fabrication of SiC Whisker- reinforced aluminium composites. Individual projects are processed separated for the data bases. (CBS)

49060 (EGG-M—31987) Mechanical properties of silicon nitride-silicon nitride joints. Neilson, R.M. Jr.; Coon, D.N. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 19p. (CONF-880504—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015095/JAW.

From 90. annual meeting of American Ceramic Society; Cincinnati, OH, USA (1 May 1988).

Oxynitride glasses in the Y--Si--Al--O--N system were used to join sintered and hot pressed silicon nitrides. Joint flexural strengths were dependent upon the joining temperature, joining glass composition, silicon nitride type, and joint morphology. Joint flexural strengths comparable to that of as-received silicon nitride were observed to test temperatures as high as 1100{degree}C, and were dependent upon joint morphology. Non-brittle behavior was observed in {open←quotes}fast fracture{close←quotes} of glass-filled joints at temperatures of 1025{degree}C. However, slow crack growth was observed in the temperature range of 900 to 1025{degrees}C. Slow crack growth was found to be strongly temperature dependent {endash} long joint lifetimes occur below 900{degree}C. Initial experiments indicated that thermal cycling did not degrade the flexural strength of glass-filled joints. 10 refs., 6 figs.

49061 (LA-UR—88-2112) Electronic structure of the quenched superconductivity materials Y/sub 1-x/Pr/sub x/Ba_2Cu_3O/sub 7-δ/. Kang, J.S.; Allen, J.W.; Shen, Z.X.; Ellis, W.P.; Yeh, J.J.; Lee, B.W.; Maple, M.B.; Spicer, W.E.; Lindau, I. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 21p. (CONF-880914—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014414/JAW.

From 18. rare earth research conference; Lake Geneva, WI, USA (11 Sep 1988).

The superconductivity of the Y/sub 1-x/Pr/sub x/Ba_2Cu_3O/sub 7-δ/ system is quenched as x increases. It has been speculated that Pr has valence 4+, resulting in extra charge in the Cu-O planes, and causing T/sub c/-quenching. To study the Pr electronic state, we have measured valence band resonant photoemission of the Y/sub 1-x/Pr/sub x/Ba_2Cu_3O/sub 7- δ/ system for x = 0, 0.2, 0.4, 0.6, 0.8, and 1.0. We find that the Pr valence is close to 3+ for all x and that the extracted Pr 4f spectral weight has a complex lineshape, implying extensive Pr 4f/O 2p hybridization which probably causes the T/sub c/-quenching by disrupting the electronic or magnetic structure of the x = 0 material, perhaps via a Pr-Cu superexchange interaction. 36 refs., 4 figs.

49062 (PB—88-215447/XAB) Advanced ceramics: a critical assessment of data-base needs for the natural gas industry. Topical report, June 1986-May 1987. Hubbard, C.R.; Dapkunas, S.J.; Munro, R.G.; Hsu, S.M. (National Bureau of Standards, Washington, DC (USA). Ceramics Div.). May 1988. 58p. (NBSIR—88-3706). NTIS, PC A04/MF A01.

A comprehensive survey was conducted to identify the materials properties of potential importance for inclusion in an advanced structural ceramics data base. The materials of current interest for use in gas-fired heat exchangers, recuperators, radiant tubes, and heat engines were determined. Existing computerized, numerical databases were surveyed and those relevant to the materials and application of interest are detailed. Analysis of the results revealed that existing databases were inadequate to fulfill the critical data needs for effective applications of advanced ceramics in gas-fired, high-temperature applications. Requirements for establishing a new data base focused on these materials, and applications are presented.

49063 (PB—88-866710/XAB) Ceramic heaters. January 1970-June 1988 (Citations from the US Patent data base). Report for January 1970-June 1988. (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 36p. NTIS PC N01/MF N01.

This bibliography contains citations of selected patents concerning ceramic heaters and their applications. Compositions and fabrication methods of ceramic composites of high oxidation resistance, thermal shock resistance, and high bending strength at high temperature for heating element manufacturing are presented. Applications include heater systems for diesel engine glow plugs, diesel-fuel filters, fuel-evaporation systems, and exhaust-gas cleaning systems. Citations of patents concerning ceramic heaters for uses in oxygen sensors and gas component detectors are included. (Contains 55 citations fully indexed and including a title list.)

49064 (PNL-SA—15891) Preparation and properties of thin film high-temperature superconductors. Pederson, L.R.; Weber, W.J.; Exarhos, G.J. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 8p. (CONF-880790—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015462/JAW.

From 21. annual technical meeting of the International Metallographic Society; Toronto, Canada (26 Jul 1988).

Thin films of high-temperature superconducting materials in the Y-Ba-Cu-O system have been prepared via a novel aqueous solution route, using glycine as a complexant. A principal advantage of this route is that no precipitation occurred during initial drying steps, yielding instead a clear, glass-like material. Films were spin-coated onto SiO_2, Al_2O_3, MgO, and (Y,Zr)TiO_3-coated SiO_2. SIMS compositional depth profiles showed that Ba segregated to the interface of SiO_2 and Al_2O_3 substrates, which severely affected the film stoichiometry. Such problems were much less pronounced with MgO or (Y,Zr)TiO_3-coated SiO_2 substrates. While superconducting properties have not been optimized, the method holds promise for inexpensive preparation of a wide range of thin film compositions. 8 refs., 3 figs.

49065 (SAND—88-1030C) Chemical preparation of powders and films for high temperature superconductors. Bunker, B.C.; Voigt, J.A.; Lamppa, D.L.; Doughty, D.H.; Venturini, E.L.; Kwak, J.F.; Ginley, D.S.; Headley, T.J.; Harrington, M.S.; Eatough, M.O. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 13p. (CONF-880408—35). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015266/JAW.

From Spring meeting of the Materials Research Society; Reno, NV, USA (4 Apr 1988).

A precipitation process has been developed to prepare precursor powders which can be calcined and sintered to form high critical temperature superconductors such as YBa_2Cu_3O/sub 7-x/. Precursor powders are prepared using a continuous precipitation system in which a solution containing highly soluble salts of the desired metal cations is rapidly and completely mixed with a solution containing precipitating anions such as hydroxide and carbonate ions. The resulting amorphous powder can be calcined to form submicron particles of desired superconducting phases which are useful in preparing inks for the ink-jet printing of superconducting interconnects. The powders can be redissolved in organic solvents to form solutions which can be used in spin or dip coating substrates with thin superconducting films. Finally, the powders have been used to prepare bulk ceramics which exhibit the highest reported critical currents of any chem-prep ceramics. Bulk samples prepared from chloride doped precursors exhibit large, oriented grains and extensive flux pinning. 11 refs., 8 figs.

49066 (UCID—21385) Directional spectral emissivity measurements on a ceramic mold material. Havstad, M.A.; McLean, W. (Lawrence Livermore National Lab., CA (USA)). 4 Apr 1988. Contract W-7405-ENG-48. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015407/JAW.

This document describes directional spectral emittance measurements made on a ceramic mold material that is to be used to cast high- temperature turbine rotors. The work was performed at {approximately}700{degree}K and 5 {times} 10/sup {minus}9/ Torr in an emissivity measurement apparatus. The results, which show how low scatter and conform to expectations derived from both theoretical relations and published ceramic data, give a total hemispherical emissivity of 0.42 {+-} 0.04 when integrated over wavelength and direction at 1000{degree}K. 3 refs., 11 figs.

49067 (UCRL—98201-Rev.1) Magnetic behavior of $Ho_1Ba_2(Cu/sub\ 1-x/Fe/sub\ x/)_3\ O/sub\ 7-y/$. Violet, C.E.; Hahn, P.A. (Lawrence Livermore National Lab., CA (USA)). Jul 1988. Contract W-7405-ENG-48. 10p. (CONF-880703—5-Rev.1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015439/JAW.

From Joint INTERMAG/magnetism and magnetic materials conference; Vancouver, Canada (11 Jul 1988).

We have carried out dc magnetization (x = 0, and 0.05) and ^{57}Fe Moessbauer spectroscopy (x = 0.05) measurements of $Ho_1Ba_2(Cu/sub\ 1{minus}x/Fe/sub\ x/)_3O/sub\ 7{minus}y/$ between room temperature (RT) and 4.2K. Based on x-ray diffraction results all samples are single phase, and either orthorhombic (x = 0) or tetragonal (x = 0.05). Magnetization measurements determined the onset T/sub c/ to be either 90K (orthorhombic) or 48K (tetragonal). Moessbauer spectra between RT and 20K are nearly identical, each consisting of three superposed quadrupole doublets. As the temperature is lowered below about 10K, the Moessbauer spectra exhibit paramagnetic relaxation. The relaxation time increases by about two orders of magnitude as the temperature decreases from 10K to 4.2K. No magnetic ordering of the Fe moments was observed. 9 refs., 4 figs.

49068 (WHC-EP—0136) The effects of irradiation on thermal conductivity of sintered Li_2O and γ-$LiAlO_2$. Ethridge, J. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 190p. NTIS, PC A09. Order Number DE88015595/JAW.

Li_2O and $LiAlO_2$ are candidates for solid breeder materials. Critical to fusion reactor breeder design efforts are thermophysical data. This investigation presents thermal conductivity data between 373--1173{degree}K for both materials following fast neutron irradiation. Samples were irradiated at 773 to 1173{degree}K to lithium burnups $\leqq$11.5 {times} 10^{20} captures/cm^3. Comparisons are made with unirradiated archive samples. Thermal conductivity of both materials was reduced at all irradiation times and temperatures; this is attributed to lattice damage. At lithium burnups greater than about 7 {times} 10^{20} capts/cm^3, measured thermal conductivity (at 500{degree}K) stabilized at approximately 70% of unirradiated values for both Li_2O and $LiAlO_2$. The most significant reductions occurred at low measurement temperatures. At higher measurement temperatures (>700{degree}K), observed thermal conductivity values approached unirradiated values. Measured thermal conductivity results were compared to calculations using high concentrations of radioinduced cation vacancies. Agreement is excellent at low lithium burnups, with slight differences at high burnup. 47 figs., 9 tabs.

49069 Optical dielectric functions for amorphous Al_2O_3 and γ-Al_2O_3. Chu, Y.T.; Bates, J.B.; White, C.W.; Farlow, G.C. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6030). *Journal of Applied Physics;* **64**: No. 7, 3727-3730(1 Oct 1988).

Using the classical oscillator model, the optical dielectric functions for amorphous alumina (a-Al_2O_3) and gamma alumina (γ-Al_2O_3) thin films prepared by ion implantation and subsequent annealing of sapphire (α-Al_2O_3) substrates were determined for the first time from analysis of infrared reflection spectra. Two transverse optical modes at 422 and 721 cm^{-1} were obtained for the a-Al_2O_3 film while four modes at 357, 536, 744, and 807 cm^{-1} were identified for the γ-Al_2O_3 film. Also, the problems involving the analysis of modes with large damping are discussed.

49070 Ar incorporation in epitaxial TiN films deposited by reactive magnetron sputtering in mixed Ar/N_2 discharges. Hultman, L.; Johansson, B.; Sundgren, J.; Markert, L.C.; Greene, J.E. (Department of Physics, Linkoeping University, S-581 83 Linkoeping, Sweden). *Applied Physics Letters;* **53**: No. 13, 1175-1177(26 Sep 1988).

TiN films were grown on (100), (110), and (111) oriented MgO by reactive magnetron sputtering from a Ti target in mixed Ar/N_2 discharges. During film growth at substrate temperatures T/sub s/ ranging from 450 to 900 °C, an applied negative substrate bias V/sub s/ (0$\leqq$V/sub s/$\leqq$600 V) was used to vary the flux and energy of impinging Ar^+ and N^+_2 ions. Electron channeling and transmission electron microscopy were used to show that films grown at T/sub s/$\geqq$550 °C were epitaxial with a defect density that decreased with increasing T/sub s/. At a constant T/sub s/ = 700 °C, the films were found to remain epitaxial as V/sub s/ was increased from 0 to 200 V, but the crystalline quality clearly deteriorated with V/sub s/ = 400 V and at V/sub s/ = 600 V the films were polycrystalline. Energy dispersive x-ray analysis showed that the trapped Ar concentration C/sub Ar/ in the films was a function of both V/sub s/ and T/sub s/. For T/sub s/ = 700 °C, C/sub Ar/ increased with increasing V/sub s/ to reach a maximum C/sup max//sub Ar/ at 400 V before decreasing again. The relative value of C/sup max//sub Ar/ varied with orientation in the following manner: (110)>(100)>(111). At a constant V/sub s/ = 400 V, C/sup max//sub Ar/ for (110) oriented films occurred at T/sub s/$\simeq$750 °C. These results are explained based upon ion channeling efficiency as a function of film orientation and defect structure.

49071 Two-dimensional antiferromagnetic excitations from a large single crystal of $YBa_2Cu_3O/sub\ 6.2/$. Sato, M.; Shamoto, S.; Tranquada, J.M.; Shirane, G.; Keimer, B. (Institute for Molecular Science, Okazaki 444, Japan). *Physical Review Letters;* **61**: No. 11, 1317-1320(12 Sep 1988).

A large single crystal (7 x 7 x 3 mm^3) of $YBa_2Cu_3O/sub\ 6.2/$ has been grown and its magnetic excitations have been observed by neutron scattering techniques. A two-dimensional magnetic ridge, similar to that observed for $La_2CuO/sub\ 4-//sub\ y/$, has been clearly identified by triple-axis measurements. The slope of the dispersion curve for spin-wave excitations is very large (approx. >0.5 eV A), consistent with the result of spin-pair Raman scattering by Lyons et al.

49072 Correlation of steady-state creep and changing microstructure in polycrystalline SiC sintered with powder derived via gaseous reactants in an arc plasma. Nixon, R.D.; Posthill, J.B.; Davis, R.F.; Baumgartner, H.R.; Rossing, B.R. (Department of Materials Science and Engineering, North Carolina State University, Box 7907, Raleigh, North Carolina 27695-7907). *Journal of Materials Research;* **3**: No. 5, 1021-1030(Sep 1988).

The mechanisms of steady-state creep in compression in a sintered SiC produced via sintering of β-SiC powders derived from gaseous reactants in a plasma arc have been determined from (1) kinetic data within the ranges of temperature and constant stress of 1770—2020 K and 17—208 MPa, respectively, and (2) the results of transmission electron microscopy (TEM) and other microbeam characterization techniques. The stress exponent was 2.06 +- 0.04; the values of activation energy were 913 +- 13 and 630 +- 14 kJ/mol above and below, respectively, a knee of $\simeq$1920 K. Gliding dislocations and B_4C precipitates, which developed within the grains during creep, and their interaction were the dominant microstructural features of the crept material. Apparent nonmechanical pinning of the dislocations at the precipitates indicated that the latter attracted the dislocations rather than acting as classical obstacles to dislocation movement. A synthesis of this information leads to the conclusion that the controlling creep mechanisms in this SiC were grain boundary sliding accommodated by grain boundary diffusion at T$\leqq$1920 K and lattice diffusion at T $\geqq$1920 K. The parallel mechanism of dislocation glide also contributed to the total strain.

49073 **(RFP-Trans—479) Process for production of filter elements.** Muehlratzer, A.; Handrick, K. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant; M.A.N. Technologie G.m.b.H., Muenchen (Germany, F.R.)). Jul 1988. Contract AC04-76DP03533. Translation of German Patent Application No. 3,628,948 A1, 3 March 1986. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014773/JAW.

Process is given for production of filter elements with deep-bed filter action from a material which is transformed to a colloidal solution and by polymerization to a solid gel. In the sol phase or a later phase, pore builders such as gas bubbles, solid particles or the like are introduced, and the gel is dried and then fired. In the firing process, the gases forming the pores escape with formation of channels which interconnect the pores. The end product is an open-celled filter element.

49074 **Process for preparing transition metal nitrides and transition metal carbonitrides and their reaction intermediates.** Maya, L. (to Dept. of Energy, Washington, DC). US Patent 4,746,501. 24 May 1988. Filed date 6 Aug 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A process for making a precursor to ceramics is described comprising: placing a transition metal halide and an alkali metal borohydride in liquid ammonia solvent resulting in the formation of an insoluble transition metal haloamide and soluble by-products, alkali metal halide and ammonium borohydride; separating the insoluble transition metal haloamide from the solvent and the soluble by-products; reacting the transition metal halomide with a salt in liquid ammonia, the salt being one that will react by displacing the halogen atom of the transition metal haloamide and yield a precursor to ceramics.

49075 **Proof-of-principle of a novel method for sputter-deposition of high T/sub c/ supeconducting films via a computer-controlled mass analyzed ion beam.** Auciello, O.; Krauss, A.R. (N. C. State University, Department of Nuclear Engineering, Raleigh, NC 27695-7909 and Argonne National Laboratory, Chemistry and Materials Science Divisions, Argonne IL 60439). *AIP (American Institute of Physics) Conference Proceedings;* **165**: No. 1, 114-121(25 Feb 1988). (CONF-871178—).

From Thin film processing and characterization of high temperature superconductors; Anaheim, CA, USA (6 Nov 1987).

A novel concept is demonstrated for ion beam sputter-induced deposition of high T/sub c/ superconductor films. The concept involves the use of a well-focused ion beam which can be sequentially directed via a set of x-y electrostatic deflection plates onto three or more different elemental or compound targets which are constituents of the desired composite film. The deflection plates are driven by two +- 1000 volt bipolar programmable power supplies which are controlled by a DEC LSI 11/73 computer. A custom program drives two D/A converters to provide the +- 10 volt analog signal which is used to drive the power supplies in such a way that the ion beam is positioned on selected spots on the different targets. By programming the dwell time for each targe according to the known sputtering yield and desired layer thickness for each material, it is possible to deposit composite films from a well-controlled sub-monolayer up to thicknesses determined only by the available deposition time. Initial results on the deposition of Y-Ba-Cu-O films are presented to demonstrate the concept, which in principle can also be applied to the deposition of high T/sub c/ superconducting films by electron- and laser-induced evaporation of elemental or oxide targets.

49076 **Atomic-level studies of superconducting YBa_2Cu_3O/sub 7-x/.** Kellogg, G.L.; Brenner, S.S. (Sandia National Laboratories, Albuquerque, NM 87185). *AIP (American Institute of Physics) Conference Proceedings;* **165**: No. 1, 421-426(25 Feb 1988). (CONF-871178—).

From Thin film processing and characterization of high temperature superconductors; Anaheim, CA, USA (6 Nov 1987).

The transmission electron microscope, field ion microscope, and imaging atom-probe mass spectrometer have been used to examine the structure and composition of field-emitter "tips" prepared from hot-pressed samples of YBa_2CuO/sub 7-x/. Transmission electron microscope images of the tip apex clearly show periodic defect structures which are interpreted as twin boundaries. Field ion microscope images reveal the structure of the samples in atomic resolution and indicate that the material can be field evaporated in a uniform, layer-by-layer fashion. Imaging atom-probe mass spectra contain signals corresponding to all the constituent elements with intensities fairly consistent with the known stoichiometry of the material.

49077 **Electronic structure of YBa_2Cu_3O/sub 7-//sub δ/ above and below T/sub c/.** Qiu, S.L.; Ruckman, M.W.; Johnson, P.D.; Chen, J.; Jiang, L.; Lin, C.L.; Strongin, M.; Sinkovic, B.; Brookes, N. (Brookhaven National Laboratory, Upton, NY 11973). *AIP (American Institute of Physics) Conference Proceedings;* **165**: No. 1, 245-253(25 Feb 1988). (CONF-871178—).

From Thin film processing and characterization of high temperature superconductors; Anaheim, CA, USA (6 Nov 1987).

The electronic structure of YBa_2Cu_3O/sub 7-//sub δ/ has been investigated using synchrotron radiation above and below the superconducting transition temperature. Valence band spectra show a low density of states at the Fermi Level, a shift of the Cu3d-O2p derived bands ~1.5 eV below their calculated binding energy and a Cu 3p-3d shake-up satellite that suggest localization of the copper 3d-states and also suggest that the copper ions have 2+ valence. Corelevel spectra also give evidence of the Cu^{3+} ion and show at least two distinct oxygen bonding environments. Cooling the surface to 20K, leaves the Cu and Ba corelevels unmodified, may produce a new O 1s corelevel component at 533 eV and causes a small change in the shape of the valence band. The Cu 3p-3d satellite is weaker and increased photoemission coincident with states derived from the O 2p orbitals at the Cu 3p threshold is noted in the valence band. These changes upon cooling suggest that small changes in the Cu-O electronic states occur and their possible relevance to superconductivity is discussed.

49078 **High-temperature superconductors: Occupied and unoccupied electronic states.** Meyer H.M. III; Gao, Y.; Wagener, T.J.; Hill, D.M.; Weaver, J.H.; Flandermeyer, B.K.; Capone D.W. II. (Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, MN 55455). *AIP (American Institute of Physics) Conference Proceedings;* **165**: No. 1, 254-263(25 Feb 1988). (CONF-871178—).

From Thin film processing and characterization of high temperature superconductors; Anaheim, CA, USA (6 Nov 1987).

The energy distributions of the occupied and unoccupied electronic states of the high temperature superconductors $La_{1.85}Sr_{0.15}CuO_4$ and $YBa_2Cu_3O_{6.9}$ have been identified using x-ray photoemission, high resolution synchrotron radiation photoemission, inverse photoemission, high resolution synchrotron radiation photoemission, inverse photemission and bremsstrahlung isochromat spectroscopy. These results show low state density from ~0.5 eV below to ~3.5 eV above the Fermi energy, E/sub F/, well-defined Cu-O occupied levels extending to ~7 eV, the occupied core levels, and the empty Ba, Y, and La states above E/sub F/. Copper is shown to be in a nominally 2+ valence state. Comparisons are made with band structure calculations.

49079 **Electronic structure of $Y_1Ba_2Cu_3O_7$.** Yarmoff, J.A.; Clarke, D.R.; Drube, W.; Karlsson, U.O.; Taleb-Ibrahimi, A.; Himpsel, F.J. (IMB Thomas J. Watson Research Center, P.O. Box 218, Yorktown Heights, NY 10598). *AIP (American Institute of Physics) Conference Proceedings;* **165**: No. 1, 264-271(25 Feb 1988). (CONF-871178—).

From Thin film processing and characterization of high temperature superconductors; Anaheim, CA, USA (6 Nov 1987).

The electronic structure of the high T/sub c/ superconductor $Y_1Ba_2Cu_3O_7$ is probed with resonant photoemission and near edge x-ray absorption spectroscopy. The parameter, U, which is a measure of the Coulomb interaction between two 3d holes at the same site, is found to be 4.6 eV. The oxidation states of the Cu atoms are determined to be 2+, while 2p holes are observed on the oxygen atoms.

49080 **Electron spectroscopic investigation of high-temperature superconducting oxides.** Rogers J.W. Jr.; Blair, D.S. (Sandia National Laboratories, Alburquerque, New Mexico 87185). *AIP (American Institute of Physics) Conference Proceedings;* **165**: No. 1, 323-335(25 Feb 1988). (CONF-871178—).

From Thin film processing and characterization of high temperature superconductors; Anaheim, CA, USA (6 Nov 1987).

High resolution X-ray Photoelectron and X-ray-excited Auger Electron Spectroscopy (XPS and XAES) have been used to study the electronic structure of La-Sr-Cu and Y-Ba-Cu superconducting oxide surfaces. The experiments were carried out on freshly cleaved (ex-situ) samples at room temperature and the results were compared with spectra obtained from Cu and CuO. The XPS Cu(2p) features show clearly that Cu^{+2} ($3d^9$) is present in the near surface region of both superconducting oxides and suggest that they are mixed valent containing both $3d^9$ and $3d^{10}$ contributions. The $3d^{10}$ contribution may result from X-ray induced reduction of Cu in the near surface region. No evidence for Cu^{+3} ($3d^8$) was found. XAES Cu(LMM) spectral features are consistent with the superposition of mixed valent Cu sites, and the hole-hole interaction energies for the Cu(LMM) transitions, a direct experimental measurement of electron correlation in the Cu 3d levels, indicate strong electron correlation.

49081 **Temperature and depth dependence of positron annihilation parameters in YBa_2Cu_3O/sub 7-x/ and La/sub 1.85/Sr/sub 0.15/CuO_4.** Lynn, K.G.; Usmar, S.G.; Nielsen, B.; van der Kolk, G.; Kanazawa, I.; Sferlazzo, P.; Moodenbaugh, A.R. (Brookhaven National Laboratory, Upton, NY 11973). *AIP (American Institute of Physics) Conference Proceedings;* **165**: No. 1, 435-442(25 Feb 1988). (CONF-871178—).

From Thin film processing and characterization of high temperature superconductors; Anaheim, CA, USA (6 Nov 1987).

The temperature dependence of the positron annihilation parameters for YBa_2Cu_3O/sub 7-//sub x/ x = 0.7, 0.4 and 0.0 and La/sub 1.85/Sr/sub 0.15/CuO_4 were measured. The depth dependence of the $YBa_2Cu_3O_7$ was studied using a variable-energy positron beam showing a strong depth dependence in the Doppler lineshape extending up to an average depth of ~5.0 μm. It was found that a transition in the Doppler line-shape parameter, "S", was associated with the superconducting transition temperature (T/sub c/) in YBa_2Cu_3O/sub 7-x/ x = 0.4 and 0.0 while no transition was observed in the nonsuperconducting YBa_2Cu_3O/sub 6.3/. Positron lifetime parameters in $YBa_2Cu_3O_7$ were found to be consistent with positrons localized at open volume regions (probably unoccupied crystallographic sites) in this material with a lifetime of 210 psec at 300 K. These results indicate that the electron density at these unoccupied sites increases, using a free electron model, approximately 9% between 100 and 12 K.

49082 **Spectroscopic examinations of surface stability of high-temperature superconductors.** Wagener, T.J.; Gao, Y.; Meyer H.M. III; Vitomirov, I.M.; Aldao, C.M.; Hill, D.M.; Weaver, J.H.; Flandermeyer, B.; Capone D.W. II. (Department of Chemical Engineering and Materials Sciences, University of Minnesota, Minneapolis, MN 55455). *AIP (American Institute of Physics) Conference Proceedings;* **165**: No. 1, 368-373(25 Feb 1988). (CONF-871178—).

From Thin film processing and characterization of high temperature superconductors; Anaheim, CA, USA (6 Nov 1987).

The surface stabilities of La/sub 1.85/Sr/sub 0.15/CuO_4 and YBa_2Cu_3O/sub 6.9/ have been studied for samples exposed to ultrahigh vacuum, oxygen, ~1500 eV electron bombardment, and zero order synchrotron radiation. Oxygen chemisorption saturates by 10 L and induces energy states ~1.6 eV above E/sub F/. High energy electron bombardment eliminates this structure for La/sub 1.85/Sr/sub 0.15/CuO_4 but not for $YBa_2Cu_3O_6$/sub ./. The effects of monochromatic photon irradiation for uv or x-ray beams are negligible, but surface modifications are observed when the sample is exposed to the zero-order white beam generated by the Aladdin synchrotron radiation source. The surface modifications are related to $BaCO_3$ residuals, probably in grain boundaries of the polycrystalline samples.

49083 **Advanced structural ceramics; Proceedings of the Symposium, Boston, MA, Dec. 1-3, 1986.** Becher, P.F.; Swain, M.V.; Somiya, S. Pittsburgh, PA; Materials Research Society (1987). 318p. (CONF-8612155—).

From Advanced structural ceramics; Boston, MA, USA (1 Dec 1986).

The present conference on advanced ceramics discusses topics in transformation analysis, transformation plasticity and toughness, the mechanical properties and microstructures of Zr-toughened ceramics, the mechanical behavior of reinforced ceramic composites, and fracture and deformation behavior in ceramic composites. Attention is given to constitutive laws for ceramics exhibiting stress-induced martensitic transformation, displacive phase transformations in Zr-based ceramics, the deformation of transformation-toughened Zr, crack propagation in Mg-partially stabilized Zr, and strength improvement in transformation-toughened ceramics using compressive residual surface stresses. Also discussed are the strength of fibers in all-ceramic composites, matrix variations in Nicalon SiC fiber-reinforced composites, strain and fracture in whisker-reinforced ceramics, and deflection-toughened corundum-rutile composites.

49084 **Oxidation and microstructure of sintered silicon nitride.** Sakai, H.; Soma, T.; Matsui, M.; Oda, I. pp 137-144 of Ceramic microstructures '86: Role of interfaces; Proceedings of the International Materials Symposium, University of California, Berkeley, July 28-31, 1986. Pask, J.A.; Evans, A.G. New York, NY; Plenum Press (1987). (CONF-860714—).

From 22. University conference on ceramics - ceramic microstructures '86: role of interfaces; Berkeley, CA, USA (28 Jul 1986).

Three sintered silicon nitrides with different kinds of grain boundary phase were oxidized and the changes in microstructure were examined. The material with glassy grain boundary phase exhibited the highest oxidation rate. The additive cations in the grain boundary migrated to the surface oxide scale, and beneath the scale, the decrease of glass phase was observed. The material with crystallized grain boundary phase of Mg-sialon and Mg_2SiO_4 also showed the high oxidation rate. The decomposition of Mg-sialon was observed in the subscale and its constituents migrated to the scale. The material with crystallized grain boundary phase of N-diopside and small amount of N-apatite produced the lowest oxidation rate. The migration of grain boundary constituents to the scale was very slow. It is considered that the oxidation resistance of sintered silicon nitride is determined by the diffusion flux of the additive cations to the scale. 6 references.

49085 **Electronic transport properties of hot-pressed B6Si.** Wood, C.; Emin, D.; Feigelson, R.S.; Mackinnon, I.D.R. pp 33-38 of Novel refractory semiconductors. Anaheim, CA; Materials Research Society (1987). (CONF-8704266—).

From Materials Research Society symposium on novel refractory semiconductors; Anaheim, CA, USA (21 Apr 1987).

Measurements of the electrical conductivity, Seebeck coefficient and Hall mobility from -300 K to -1300 K have been carried out on multiphase hotpressed samples of the nominal composition B6Si. In all samples the conductivity and the p-type Seebeck coefficient both increase smoothly with increasing temperature. By themselves, these facts suggest small-polaronic hopping between inequivalent sites. The measured Hall mobilities are always low, but vary in sign. A possible explanation is offered for this anomalous behavior. 13 references.

49086 **Electrical response of electrochemical capacitors based on high surface area ruthenium oxide electrodes.** Raistrick, I.D.; Sherman, R.J. (Los Alamos National Lab., Los Alamos, NM (US)). pp 582-593 of Electrode materials and processes for energy conversion and storage. Srinivasan, S.; Wagner, S.; Wroblowa, H. Pennington, NJ; The Electrochemical Society (1987). (CONF-8705216—).

From 2. symposium on electrode materials and processes for energy conversion and storage; Philadelphia, PA, USA (11 May 1987).

Electrochemical capacitors based on high-surface-area ruthenium dioxide thin-film electrodes have been fabricated and examined for energy storage and conditioning applications. A simple fabrication process has been developed to optimize the capacitance, and the oxide layers have been characterized by a variety of techniques. The electrical response of the electrodes in acid media has been examined using small signal ac impedance techniques. The mechanism of charge storge and the origin and form of the dynamic response are discussed.

3606 Other Materials

REFER ALSO TO CITATION(S) 48255, 48278, 48397, 48398, 48399, 48400, 48405, 48405, 48505, 48505, 48609, 48668, 48668, 48816, 48836, 48836, 48999, 49059, 49063, 49068, 49217, 49270, 49271, 49444, 50029, 50232, 50234, 50237, 50242

49087 (AD-A—193207/8/XAB) Effect of thermal treatment on the mechanical and toughness properties of extruded SiC/sub w/aluminum 6061 metal-matrix composite. Final report. Hasson, D.F.; Hoover, S.M.; Crowe, C.R. (Naval Surface Weapons Center, Silver Spring, MD (USA). White Oak Lab.). 31 Jan 1987. 30p. (NSWC-TR—86-72). NTIS, PC A03/MF A01.

Mechanical, instrumented Charpy V-notch (CVN) energy and plane strain fracture-toughness properties of SiC whisker reinforced 6061 aluminum-metal-matrix composite material from an extruded tube were determined. The effect of thermal treatment and orientation were studied. The mechanical-strength properties are higher than wrought Al 6061 in the T6 condition. CVN energy values, however, were reduced by an order-of-magnitude Kic fracture toughness of the as-received, T6 and degassed + T6 thermal treatments were 50% of the wrought Al 6061 alloy. The effect of orientation showed that the orientation with the least amount of SiC whisker in the crack plane (i.e., greatest mean free path between reinforcements) yields the highest toughness value.

49088 (AD-A—193227/6/XAB) Far- and mid-infrared properties of metal-insulator composite materials. Annual Letter report, 1 January-31 December 1987. Devaty, R.P. (Pittsburgh Univ., PA (USA)). 1987. 18p. NTIS, PC A03/MF A01.

Construction of the far-infrared Fourier transform spectrometer was completed so that attention could now be focused on experiments. Among the highlights are: *SPECAC Interferometer: design and construction of mylar beam splitters, which can be used in place of the supplied free-standing wire grids to extend the high-frequency cutoff of the instrument from 200/cm to at least 350/cm; design and construction of an output focusing mirror to replace the supplied TPX lens; use of the mirror increases the throughput of the interferometer, especially at high frequencies; design and construction of an optical chopper to modulate the Hg arc source for use with lock-in detection; the chopper can be used rather than phase modulation (vibrating the fixed mirror of the interferometer). Both methods have advantages and drawbacks, so it is desirable to have both.

49089 (AD-A—193276/3/XAB) Paramagnetic point defects in boron-implanted Hg0.7Cd0.3Te. Technical report. Bowman, R.C.; Venturini, E.L.; Witt, S.N. (Aerospace Corp., El Segundo, CA (USA). Chemistry and Physics Lab.). 1 Feb 1988. 22p. (TR—0086(6945-07)-4). NTIS, PC A03/MF A01.

Initial observations of electron paramagnetic resonance (EPR) spectra from Hg0.7Cd0.3Te and CdTe after implantation with boron ions are described. Sharp and nearly isotropic EPR signals with the free-electron g-values were easily detected at low temperatures (= or > 78 K) when the boron-ion implant dose was 1 x 10^{16} ions/sq cm or larger. For identical implant conditions, more intense signals and narrower peaks were obtained from Hg0.78Cd0.3Te samples than from CdTe samples. However, the g-factors for all implanted Hg(1-x)Cd(x)Te samples appear to be equivalent and are similar to the values reported for the dangling-bond defects in other ion-implanted semiconductors. The EPR spectra produced by the boron implants do not correspond to either the degenerate conduction electron bands that form in ion-implanted Hg(1-x)Cd(x)Te or to the shallow donor states previously found in chemically doped CdTe. When implanted crystals are cooled below 4 K, partially resolved, two-component line shapes are observed at some orientations. Increasing the temperature causes these two-component lines to collapse into nearly Lorentzian line shapes with temperature-dependent widths. This behavior is consistent with a thermally activated process by which the paramagnetic spins hop between different locations.

49090 (AD-A—193279/7/XAB) Growth of GaAs on SiO(x) by molecular-beam epitaxy. Chin, A.; Bhattacharya, P.K.; Kothiyal, G.P. (Michigan Univ., Ann Arbor (USA)). 15 Aug 1987. 5p. NTIS, PC A02/MF A01.

Pub. in Jnl. of Applied Physics, Vol. 62, No. 4, 1416-1419(15 Aug 1987).

The authors investigated the molecular-beam epitaxial growth and photoluminescence properties of gallium arsenide on SiOx. It is seen that material with a grain size of 0.6-0.8 μm can be grown directly on the dielectric. The properties improve further when the layers are short-term annealed with a halogen lamp. Optimum grain sizes of 1.6 μm are obtained when the as-grown material is annealed at 950 C for 10 s, and very strong luminescence is observed in the same material. Photoconductive detectors made on the overgrown gallium arsenide show large responsivities. Selective epitaxy is likely to become an increasingly important technology for the realization of two- and three-dimensional integrated devices. By proper annealing of the overgrown polycrystalline gallium arsenide on SiOx, it is possible to drastically increase integration density and speed of integrated circuits. Because of the various limiting physical effects and increasing parasitic effects as the device dimensions are reduced, it is important to improve the quality of the overgrown gallium arsenide. There is, therefore, an intrinsic need to study the process of overgrowth, which also opens up the possibility of placing active electronic and optoelectronic devices on SiOx and on silica fibers.

49091 (AD-A—193293/8/XAB) Migration and stability of HgCdTe lattice defects. Final report, 24 June 1985-30 December 1987. Kikuchi, R. (Washington Univ., Seattle (USA). Dept. of Materials Science and Engineering). 29 Feb 1988. 32p. NTIS, PC A03/MF A01.

Continuing from previous work on equilibrium phase diagrams of Hg-Cd-Te systems, diffusion of Hg and Cd in HgCdTe has been studied in this project. The path probability method (PPM) of irreversible statistical mechanics is used with a point as the basic cluster. Basic formulation of diffusion: gradient of atomic density is applied to the system and the responding atomic flux is formulated. It is noteworthy to see that a chemical potential gradient appears quite naturally as the driving force, as the Onsager theory requires, rather than the atomic density gradient. Hg fast diffusion: it is made of two branches. In the vacancy mechanism branch, diffusion decreases with Hg vapor pressure, P(Hg), while it increases in the interstitial mechanism branch. Equations are derived to show these branches and curves for the diffusion coefficient are plotted. Experimentally observed activation energy is given atomic interpretation.

49092 (AD-A—193336/5/XAB) Laser spectroscopy of quantum well and superlattice structures. Interim report No. 1, 3 December 1987-2 February 1988. Henderson, B. (Strathclyde Univ., Glasgow (UK)). 15 Feb 1988. 15p. NTIS, PC A03/MF A01.

The research described in this report aims to understand the effects of disorder on the lineshapes of exciton luminescence in quantum-well (QW) materials. The low-temperature photoluminescence (PL) and photoluminescence excitation (PLE) spectra of the excitonic transition in QW material are a sensitive test of interfacial quality. Contributions to the linewidth arise from homogeneous (lifetime) and inhomogeneous (disorder) effects. In a typical 50-A well in GaAs, a linewidth at low temperatures of a few meV compares to a typical linewidth about one hundred times smaller in bulk material.

49093 **(AD-A—193444/7/XAB) Notched-fatigue behavior of an aluminum composite reinforced unidirectionally with silicon carbide fiber.** Tsangarakis, N. (Army Materials Research Agency, Watertown, MA (USA). Materials Technology Lab.). Nov 1987. 18p. (MTL-TR—88-13). NTIS, PC A03/MF A01.

Pub. in Jnl. of Composite Materials, Vol. 21, 1008-1016(Nov 1987).

The sequence of fatigue damage accumulation in silicon carbide-fiber-reinforced aluminum plates with circular holes and the essence of the notch endurance limit of this composite are analyzed. The affects of specimen size and hole aspect ratio on the fatigue life of these plates are discussed and rationalized.

49094 **(AD-A—193473/6/XAB) PLZT (lead-lanthanum-zirconium-titanium) electro-optic photographic system. Technical report, 14 July-31 July 1987.** Brown, L.L. (Denver Univ., CO (USA)). 31 Jul 1987. 51p. NTIS, PC A04/MF A01.

The challenge of this effort was to develop and field a lead-lanthanum-zirconium-titanium (PLZT) electro-optic enhanced photographic system, for high-speed photographic documentation of Thermal Radiation Sources (TRS)/High explosive (H.E.) detonations. Operational design parameters of this system were to have a 6 f-stop dynamic range and pulse response of 100 micro-seconds or less. A prototype PLZT system was designed/fabricated and laboratory tested with a wide variety of dynamic light sources that had substantially different spectral characteristics and radiant output. The prototype system performed satisfactorily for these test series and consequently a semi-hardened unit was fabricated for field use. The fabricated field unit was successfully tested with rocket-propellant burns that simulated light intensities within the camera/PLZT systems field of view (FOV). These test results provided the confidence that the system was ready for deployment to a large-scale test site. The PLZT photographic system was fielded on Project MISTY PICTURE to record the total TRS burn at the 10-psi (69 Kpa) overpressure environment. Several pre-vent TRS burns were recorded. These film records were analyzed and electronic adjustments were made to optimize the dynamic range of the PLZT system. The PLZT system was subsequently tested on the MISTY PICTURE event. Film analysis of the event shows that the system performed over its 6 f-stop range, allowing one camera to record the total TRS burn.

49095 **(AD-A—193543/6/XAB) Arsenic growth on the gallium arsenide surface during oxidation.** Martin, R.; Braunstein, R. (California Univ., Los Angeles (USA). Dept. of Physics). 1987. 5p. NTIS, PC A02/MF A01.

Pub. in Jnl. of Physics and Chemistry of Solids, Vol. 48, No. 12, 1207-1212(1987).

Crystalline arsenic was observed to grow on the surface of GaAs during exposure to continuous-wave laser radiation. A study of the time development of the arsenic growth as revealed by Raman backscattering indicated that a surface diffusion process was responsible for limiting the growth process. Temperature measurements were performed from which the diffusion-barrier energies were obtained for various GaAs samples. From these results the diffusion process was shown to depend on the Fermi level of sample.

49096 **(AD-A—193661/6/XAB) Whisker-reinforced ceramic-matrix composites.** Homeny, J.; Vaughn, W.L. (Illinois Univ., Urbana (USA)). 15 Nov 1986. 8p. NTIS, PC A02/MF A01.

Pub. in MRS Bulletin, 66-71, 1 October-15 November 1987.

The role of whisker/matrix interfacial characteristics on the toughening mechanisms in SiC whisker/Al_2O_3 matrix composites was investigated. Specifically, the surface chemistry of two whisker types (Silar SC-9 and Tateho SCW-1S) was correlated to the fracture toughness of the composites. ESCA analysis of the whisker surfaces revealed that the Silar SC-9 whiskers contained Si-C, Si-O, and C-C species and that the Tateho SCW-1S whiskers showed only Si-C species. Composites produced with Silar SC-9 whiskers exhibited enhanced fracture toughness compared to unreinforced Al_2O_3, while composites produced with Tateho SCW-1S whiskers exhibited toughness levels similar to unreinforced Al_2O_3. It is believed that the presence of the Si-O and C-C species on the whisker surfaces prevents a strong chemical bond at the whisker/matrix interface and allows the activation of toughening mechanisms, such as crack deflection and whisker bridging/pullout.

49097 **(AD-A—193722/6/XAB) Magnetic properties of Pb(1-x)Gd(x)Te.** Gorska, M.; Anderson, J.R.; Golacki, Z. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). 1987. 6p. NTIS, PC A02/MF A01.

Pub. in Materials Research Society Symposium Proceedings, Vol. 89, 119-123(1987).

The magnetization and magnetic susceptibility of Bridgman-grown Pb(1-x)Gd(x)Te were measured over a temperature range from 2 to 300 K and in magnetic fields from 0.01 to 50 kOe. The x values of the crystals ranged from 0.03 to 0.07. The magnetic susceptibility followed a Curie-Weiss behavior, X = C/(T + theta), with positive theta implying an antiferromagnetic exchange interaction between Gadolinium ions. The magnetic-field dependence of the magnetization was fitted to a modified Brillouin function with parameter values that agreed fairly well with those from Curie-Weiss plots. The magnitude of theta was comparable to the value found for Pb(1-x)Mn(x)Te for similar x values; but since the ion spin is larger for Gd this suggests that the exchange interaction in Gd-doped lead telluride is roughly half the value in Manganese-doped PbTe.

49098 **(AD-A—193849/7/XAB) Ultrafine-microstructure composites prepared by chemical vapor deposition. Annual report, January-December 1987.** Lackey, W.J.; Freeman, G.B.; Smith, A.W.; Thompson, J.R.; Gerard, G.J. (Georgia Inst. of Tech., Atlanta (USA). Research Inst.). Dec 1987. 33p. (GTRI-A—4699-1). NTIS, PC A03/MF A01.

The goal is to develop an analytical model that predicts the experimental conditions that permit the preparation of ultrafine-microstructure ceramic composites by chemical vapor deposition (CVD). The model is to be based on classical thermodynamics, mass transport, kinetic, nucleation, and growth theory. The model will be validated for two dispersed-phase composite systems. One system will be boron nitride plus aluminum nitride; the other hafnium diboride plus silicon carbide. The BN + AlN system is of interest for radomes, windows, and tribological applications while HfB2 + SiC offers potential as a high-temperature oxidation-resistant material including oxidation protective coatings for carbon-carbon composites. Thermodynamic analyses of the BN + AlN and the HfB_2 + SiC systems were completed. These computerized studies indicate that both composite systems can be prepared by codeposition using commercially available, conventional reagents.

49099 **(AD-A—193868/7/XAB) Durability of continuous fiber-reinforced metal-matrix composites. Final report, September 1983-December 1986.** Harmon, D.M.; Saff, C.R.; Sun, C.T. (McDonnell Aircraft Co., St. Louis, MO (USA)). Oct 1987. 219p. NTIS, PC A10/MF A01.

The objective of this program was to develop the test data and analysis techniques required to insure the structural integrity of fiber-reinforced metal-matrix composites (FRMMC) when applied to airframe structures. Approximately 300 tests of unidirectional boron/6061 aluminum, (B_4C)/15-3-3-3 titanium, and crossplied boron/6061 aluminum were performed. Testing was concentrated on notched (central hole) specimens to evaluate the notch sensitivity of these materials and to discriminate between the failure modes of aluminum- and titanium-matrix composites. It was found that the relative fiber and matrix stiffnesses and strengths determine primary failure modes in fatigue. Analysis methods were developed based on fiber and matrix properties to predict notched and unnotched static strength, crack initiation, fatigue failure mode, life to failure, and residual strength. One half of the tests (150 specimens) were performed to verify the predicted properties of the aluminum- and titanium-matrix composites.

49100 **(AD-A—194036/0/XAB) VPE-hydride technique with alloy source: equilibrium analysis. Report for 8 March-15 July 1987.** Quinlan, K.P. (Air Force Rome Air Development Center, Griffiss AFB, NY (USA)). Nov 1987. 26p. (RADC-TR—87-218). NTIS, PC A03/MF A01.

An equilibrium analysis of the Vapor Phase Epitaxy(VPE)-hydride technique using an alloy source was completed with the analysis method of Quinlan. Results of the analysis are in close agreement with the experimental findings of other investigators. The compositions of the InxGa(1-x)As are dependent on the alloy compositions, and the initial partial pressures of hydrogen chloride and arsenic. The indium content of the ternaries increases with increasing arsenic pressures below .001 atm and remains constant above this value. The analysis indicates that the lattice matched In(0.53)Ga(0.47)As can continually be prepared from the same alloy by changing the initial partial pressures of hydrogen chloride.

49101 **(ANSTO/E—664) X-ray powder diffraction pattern and lattice parameters of perovskite.** Ball, C.J.; Napier, J.G. (Australian Nuclear Science and Technology Organisation, Lucas Heights). Feb 1988. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703950/JAW.

The interplanar spacings and intensities of all lines appearing in the X-ray powder diffraction pattern of perovskite have been calculated. Many of the lines occur in groups with a large amount of overlap. As an aid to identifying the lines which are observed, the intensity profiles of the major groups have been plotted. Those lines which are relatively free of overlap and can be identified unambiguously have been used to calculate the lattice parameters, with the results a=5.4424 +- 0.0001 A, b=7.6417 +- 0.0002 A, c=5.3807 +- 0.0001 A.

49102 **(CONF-880813—2) The detection of conformational disorder by thermal analysis.** Wunderlich, B. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012932/JAW.

From 9. international congress on thermal analysis: ICTA 9; Jerusalem, Israel (21 Aug 1988).

Conformational disorder in crystals is found in many molecules that possess a plurality of conformational isomers. Typical examples are linear macromolecules such as polyethylene, polytetrafluoroethylene and trans-1,4-polybutadiene; and small molecules such as paraffins, cycloparaffins, soaps, lipids and many liquid-crystal forming molecules. Conformational motion is often coupled with the cooperative creation of disorder. In this case a heat and entropy of transition is observed by thermal analysis. Levels of transition entropies can be estimated, assuming most of the disorder can be traced to conformational isomerism. In case there is conformational disorder frozen-in at low temperature, thermal analysis can be used to find the glass transition of a condis crystal. An Advanced Thermal Analysis System has been developed, and will be described that permits a detailed interpretation of the thermal analysis traces. It rests with the establishment of high quality heat capacity for the rigid solid state (vibration only) and the mobile liquid state (vibrations and large amplitude cooperative motion). 36 refs., 3 figs.

49103 **(CONF-880841—10) Analytical TEM [transmission electron microscope] study of a yttria stabilized zirconia/glass composite.** Lin, Yung-Jen; Angelini, P.; Mecartney, M.L. (Minnesota Univ., Minneapolis (USA). Dept. of Chemical Engineering and Materials Science; Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400;AC05-76OR00033. 2p. (CONF-880841—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88009699/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

This study seeks to elucidate the effects of glass grain boundary phases on grain growth in yttria-stabilized ZrO_2 ceramics. ZrO_2 with 0 to 8 mol% Y_2O_3 were mixed with 5 wt % borosilicate glass. It was found that the glass prevented the formation of facetted zirconia grains, and that the dependence of grain size in the yttrium composition remained unchanged. EDS suggested that the yttria partitioning in the 3 mol% specimen also plays an important role in controlling grain growth. 5 refs., 4 figs. (DLC)

49104 **(CONF-8711114—5) Laser photochemical growth of amorphous silicon at low temperatures and comparison with thermal chemical vapor deposition.** Eres, D.; Lowndes, D.H.; Geohegan, D.B.; Mashburn, D.N. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014547/JAW.

From Symposium on high temperature superconductors; Boston, MA, USA (30 Nov 1987).

Pulsed ArF (193 nm) excimer laser radiation has been used to dissociate disilane (Si_2H_6, resulting in photochemically controlled deposition of amorphous Si thin films. A high stability HeNe (6328 A) laser was used for precise in situ monitoring of film deposition rates, under varying deposition conditions. A helium window purge nearly eliminated Si film deposition on the chamber windows. With the excimer laser beam parallel to the substrate, deposition of amorphous Si can be controlled entirely by the photon fluence (negligible background thermal growth) at temperatures from room temperature up to {approximately}400{degree}C. Reasonable photolytic deposition rate (>1 A/sec) are combined with 'digital' control of film thickness ({approx←gt}0.02 A/laser pulse). Activation energies of 1.50 (+-0.1) eV and 0.09 (+-0.02) eV were found for pyrolytic and photolytic deposition, respectively. 15 refs., 3 figs.

49105 **(DOE/ER/13455—2) Picosecond studies of electron transfer processes at semiconductor interfaces.** Miller, R.J.D. (Rochester Univ., NY (USA). Dept. of Chemistry). 1988. Contract FG02-85ER13455. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014667/JAW.

To study the dynamics of surface electron transfer processes, three, highly surface specific, optical probes have been developed in conjunction with semiconductor liquid junctions: surface restricted transient gratings, optically generated surface acoustic waves, and in-situ electro-optic sampling of surface space charge fields. These three optical probes have been employed to measure interfacial carrier population dynamics, interface structure and carrier thermalization, and surface transport respectively at TiO_2(001) and GaAs(100) interfaces. 3 refs., 3 figs.

49106 **(DOE/ER/45193—T5) The synthesis and properties of novel organometallic polymers: [Progress report].** Rosenblum, M. (Brandeis Univ., Waltham, MA (USA)). 21 Jul 1988. Contract FG02-85ER45193. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015459/JAW.

Object of this research is to synthesize a number of organometallic polymers based on complexes of 1,8-bis(cyclopentadienyl)naphthalene 1 as a basic structural unit, and to examine the physical properties of these substances, especially their electrical conductance, and magnetic behavior. In macromolecular arrays formally derived from transition metal complexation of 1, contiguous organometallic units are held face-to-face in a columnar array, so that charge conduction or spin correlation may be achieved through π-orbital interaction of neighboring cyclopentadienyl rings. The general structural form is illustrated by the polymetallocene 2. We have developed simple synthetic methodologies for the preparation of polymers such as 2, (M = Fe,Ru), and now propose to examine the synthesis of analogous polymers incorporating other transition metals, especially cobalt and nickel. A new and more general approach to the synthesis of this class of organometallic polymer, recently devised in our laboratories, should make it possible to prepare alternating mixed metal arrays of such polymers, as well as systems based on linear dimeric, trigonal trimeric and tetrahedral tetrameric cyclopentadienyl complexes. 61 refs., 3 figs.

49107 **(DOE/ER/45250—2) Investigation of the MBE growth and properties of Al/sub y/Ga/sub y/In/sub 1-x-y/As/InP and InGaAs-InAlAs superlattices: Progress report for May 15, 1986--August 1, 1988.** Bhattacharya, P.K.; Gibala, R. (Michigan Univ., Ann Arbor (USA). Dept. of Electrical Engineering and Computer Science). 1988. Contract FG02-86ER45250. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015477/JAW.

The focus of the work has been to grow wide-bandgap ternary and quaternary semiconductors InAlAs and InGaAlAs by mo-

lecular beam epitaxy and to investigate their electronic, optical and structural characteristics. The techniques being used are x-ray, TEM, photoluminescence and absorption, DLTS, Hall transport, and Raman Spectroscopy. The experiments have included both lattice matched and strained layers. Several new results have been obtained. 16 refs. 4 figs.

49108 **(DOE/ER/45267—2) Surfaces and thin films studied by picosecond ultrasonics: Annual progress report for period December 1, 1987--November 30, 1988.** Maris, H.J.; Tauc, J. (Brown Univ., Providence, RI (USA). Dept. of Physics). 1988. Contract FG02-86ER45267. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015268/JAW.

The research is in two related areas. The first is the development of the techniques of picosecond ultrasonics and the practical application of these techniques to the non-destructive study of thin film structures. The second area is the study using this technique of fundamental problems in ultrasonics and lattice dynamics. We have completed our study of the vibrational normal modes Ge:Si multilayer structures, including a theoretical investigation of the conditions under which surface modes occur in such structures. We have continued our experimental study of the Kapitza resistance and its temperature dependence, and have compared experimental results with a theoretical calculation. We have used the picosecond ultrasonic technique to measure the sound velocity and refractive index of AlAs, and we have studied the sound velocity in a series of silicon oxynitride films of varying composition.

49109 **(DOE/ER/45274—2) Thermodynamics and kinetics of phase formation of thin-film metal on gallium arsenide.** Chang, Y.A. (Wisconsin Univ., Madison (USA). Dept. of Metallurgical and Mineral Engineering). 1988. Contract FG02-86ER45274. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015702/JAW.

Objectives are to study the thermodynamics and kinetics of reactions between selected metals and GaAs in the bulk and thin-film forms. Even though micro-electronics devices are made of thin-films, their reactions cannot be rationalized without an understanding of the bulk phenomena. In fact, it is our belief that if we understand the thermodynamics and kinetics of the bulk reactions, we can forecast what may happen in thin-films, with perhaps the exception of epitaxial formations. In order to understand the bulk reactions between metals and GaAs, we need to know (1) the ternary phase diagram of Ga-As-M, (2) the diffusion path of GaAs/M in the bulk form and (3) reaction sequence between GaAs and M. Results obtained for items (2) and (3) in the bulk form are correlated with the results obtained for thin films. This paper summarizes the results obtained for several GaAs/M systems.

49110 **(DOE/MC/24160—2552) Reaction kinetics and simulation models for high-temperature desulfurization sorbents: Technical progress report 1, October 1, 1987-December 31, 1987.** Harrison, D.P.; Woods, M.C. (Research Triangle Inst., Research Triangle Park, NC (USA); Louisiana State Univ., Baton Rouge (USA)). Jan 1988. Contract AC21-87MC24160. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006864/JAW.

The overall objectives of this project are to investigate reaction kinetics and develop simulation models for novel high temperature desulfurization sorbents tested were zinc ferrite and a zinc oxide- titanium oxide. The fractional conversion of sorbents selected by DOE will be measured during sulfidation and regeneration in a TGR over the temperature range of 1000 to 15000{degree}F and the pressure range of 1 to 20 atm. The chemical and physical property changes which occur in the sorbents during sulfidation and regeneration will be evaluated and their impact on the rate of reaction and sorbent capacity will be determined. Single particle and multiparticle models will be developed based on the TGR tests and used to simulate bench scale test results. Results are presented and discussed. 2 figs., 5 tabs.

49111 **(DP-MS—87-175) Gamma irradiated SRP nuclear waste glass: Microstructure and durability.** Bibler, N.E.; Howitt, D.G.; Heuer, J.P. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 23p. (CONF-880504—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013954/JAW.

From 90. annual meeting of American Ceramic Society; Cincinnati, OH, USA (1 May 1988).

Results are reported for microstructural changes and leach rates of internal samples of large pieces of SRP nuclear waste glass that had been exposed to high doses of Co-60 gamma rays. Earlier experiments using small samples of glass have shown that gamma radiation causes microstructural changes in the glass. Internal samples were examined to determine if the earlier results were affected by radiation induced chemical reactions at the glass/air interface. Based on TEM analysis, microstructural changes in the internal samples were identical to those observed earlier. Based on leach tests in deionized water, the damage did not affect the durability of the glass. 2 refs., 12 figs.

49112 **(EGG—10282-2148) The photocapacitance of the HgI_2/electrolyte system.** Burger, A.; Akujieze, J.K.; Silberman, E.; Franks, L.A.; Schnepple, W.F. (Fisk Univ., Nashville, TN (USA). Dept. of Physics; EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). 1987. Contract AC08-83NV10282. 23p. (CONF-8709315—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014956/JAW.

From 6. international workshop on compound semiconductors for room temperature X-ray and nuclear detectors; Davos, Switzerland (14 Sep 1987).

Electrochemical photocapacitance spectroscopy (EPS) measurements in the range 1.5--2.3 eV are reported for mercuric iodide (HgI_2) crystals. Two peaks in the photocapacitance were identified at 1.75 and 1.64 eV. The determination of densities of states and kinetic parameters is presented and the results are compared with the results obtained by using the thermally stimulated currents (TSC) method, as reported in the literature. 21 refs., 5 figs., 1 tab.

49113 **(EGG—10282-2180) Pressure/temperature sensitive inorganic phosphors.** Seals, W.O.; Offen, H.W.; Turley, W.D. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). 1987. Contract AC08-83NV10282. 20p. (CONF-8710353—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014977/JAW.

From JANNAF (joint army, navy, NASA, air force) conference; Monterey, CA, USA (8 Oct 1987).

Kistler gauges are presently used to monitor pressures generated in various types of experimental tests. When a one-gallon container of stores liquid propellant was impacted by a shaped charge, hydraulic pressures in excess of 100,000 psi were produced. This destroyed the gauges. A class of inorganic phosphors, including rare earth-doped lanthanum oxysulfide (La_2O_2S:Eu) and yittrium oxysulfide (Y_2O_2S:Eu), show spectral emission characteristics that are strongly pressure dependent. The intensity of the emission lines and fluorescence decay time if individual emission lines show pressure dependence in the range of several kbar to greater than 100 kbar. These properties suggest that these phosphors could be applied as remotely operated pressure transducers. In addition phosphors show temperature dependence. This paper discusses the potential of inorganic phosphors to measure high pressure and also examines temperature effects. 5 refs., 7 figs

49114 **(EPRI-EL—5921) Morphology of extruded dielectric cable insulation: Final report.** Phillips, P. J. (Electric Power Research Inst., Palo Alto, CA (USA); Tennessee Univ., Knoxville (USA). Dept. of Materials Science and Engineering). Jul 1988. 150p. Unlimited audience, publicly available. Research Reports Cente, Box 50490, Palo Alto, CA 94303. Order Number TI88014884/JAW.

This study examines the physical structure of extruded crosslinked polyethylene cable insulation and the changes produced by thermal aging. Findings in the laboratory and the field show that the physical structure changes at the submicron level. After annealing at temperatures up to 93{degree}C, dielectric strength deteriorates; in the 98-107{degree}C range, it improves. 11 figs., 21 tabs.

49115 (INIS-BR—1147-Vol.2, pp 415-422) **Evaluation of gamma radiation effects on stationary phases using gas chromatografy.** Basso, M.A.; Collins, K.E.; Collins, C.H. (Universidade Estadual de Campinas (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The overall objetive of this project is a thorough study of the effect of gamma radiation on supported stationary phases used in packed-column gas chromatography. The phases studied were SP-2100 on Supelcoport and SE-30 on Chromsorb W. The phases were irradiated with cobalt-60 gamma rays to various doses and subsequently subjected to tests of extractability, termal stability and efficiency as a chromatographic column packing. Extraction tests indicate that low doses of radiation are sufficient to produce significant immobilization of these polymethylsilicones; that is, to produce chemical bonds between different polymer chains or between the stationary phase and the support. Thermal stability is also increased. The values calculated for the number of theoretical plates (n) and resolution (Rsub (s)) after analysis of four synthetic mixtures of organic compounds also increase, in most cases, indicating that the gamma irradiation has positively altered the behavior of these stationary phases.

49116 (INIS-BR—1147-Vol.3, pp 59-62) **Development of a system for determining the thermoluminescent glow curve of solid materials from 77K to room temperature.** Rosa, L.A.R. da; Leite, N.G.; Caldas, L.V.E. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil); Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

It was developed a system to determine the thermoluminescent glow curve of solid samples from 77K up to room-temperature. This system permits a linear heating of the samples with different heating-rates and their annealing at a fixed temperature. The system operates at a pressure of 1.33 x 10/sup -3/Pa.

49117 (INIS-mf—11305) **Ninth national conference of the South African Section of the PRI.** (Plastics and Rubber Inst., Johannesburg (South Africa). South Africa Section). 1987. 515p. (CONF-8710365—). NTIS (US Sales Only), PC A22/MF A01. Order Number DE88703920/JAW.

From 9. national conference of the South African Section of the PRI; Johannesburg, South Africa (22 Oct 1987).

This publication contains the papers of the ninth national conference of the South African Section of the Plastics and Rubber Institute held at Johannesburg on the 22nd and 23rd October 1987. The papers cover the different applications of polymers and two seminars particularly discuss the chemical radiation effects on polymers.

49118 (INIS-mf—11305, pp 17) **Radiation effects on polymers and elastomers.** Badenhorst, D.A. (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria). 1987. NTIS (US Sales Only), PC A22/MF A01. Order Number DE88703920/JAW. (CONF-8710365—).

From 9. national conference of the South African Section of the PRI; Johannesburg, South Africa (22 Oct 1987).

Radiation damage is discussed with respect to the various factors influencing such damage. Polymers are classified to the predominant reaction resulting from irradiation (Crosslinking or Scission). Radiation effects on P.V.C. and E.P.D.M. are briefly examined as examples of thermoplastic and elastomeric materials. Brief mention is made of wood plastics. Tables giving damage thresholds of common polymers and elastomers are given.

49119 (INIS-mf—11305, pp 9) **Radiation crosslinked polymers in the building industry.** Du Plessis, T.A.; Smit, J.H. (Iso-Ster (Pty.) Ltd., Kempton Park (South Africa)). 1987. NTIS (US Sales Only), PC A22/MF A01. Order Number DE88703920/JAW. (CONF-8710365—).

From 9. national conference of the South African Section of the PRI; Johannesburg, South Africa (22 Oct 1987).

The South African building industry today is presented with a unique challenge to provide alternative low-cost housing at a rate that conventional construction methods and materials cannot meet. It is generally acknowledged that the locally produced polymers such as polyethylene and polyvinylchloride can alleviate some of the problems encountered with conventional construction techniques. The radiation-modification of these polymers plays an ever increasing role in modifying the physical properties and extending the applications of these materials. Whereas in the past the technical and economic aspects inherent in this technology restricted the more general use of radiation crosslinking, large-scale irradiation facilities are now available on a service basis for the radiation-modification of polymers and can thus overcome these earlier limitations - especially so in the case of the smaller convertor. In agreement with the crosslinking of thermoplastics in general, radiation crosslinking can lead to important changes in the polymer properties such as, an improvement in the thermal stability thereof and the suppression of its flammability, an improvement in its dimensional stability and many other mechanical properties including abrasion resistance. This process also improves the resistance to common solvents for these polymers. Recent developments in South Africa to enhance the properties of common thermoplastics for the building industry through radiation processing is discussed.

49120 (LA-UR—88-2006) **Production and properties of perrhenate-doped alkali halide crystals.** Nestor, O.H.; Figueira, J.F. (Harshaw/Filtrol Partnership, Cleveland, OH (USA); Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 8p. (CONF-8710165—15). NTIS, PC A02. Order Number DE88014430/JAW.

From Boulder damage symposium; Boulder, CO, USA (26 Oct 1987).

The growth and selected properties of single crystals of KCl doped with ReO{sub 4}{minus}} is described. The crystals have been used as saturable absorbers to modulate and control CO{sub 2} laser radiation. ReO{sub 4}{minus}} ion concentrations in excess of 10{sup 17} cm{sup {minus}3} were achieved in KCl with good optical quality. The room temperature absorption of the ReO{sub 4}{minus}} ion in KCl was centered at 936.8 cm{sup {minus}1} with 1.5 cm{sup (minus}1} linewidth and with absorption cross section determined to be (0.46 + 0.02) {times} 10 {sup {minus}16} cm{sup 2}. The addition of Li{sup {plus}} as a second dopant resulted in a splitting of the ReO{sub 4}{minus}} resonance into two components at 957.5 cm{sup {minus}1} and 900.7 cm{sup {minus}1}. The characteristically sharp resonance of ReO{sub 4{minus}} was not detected in NaCl grown with NaReO{sub 4} additions to the melt. Only with addition of Ca{sup ++} as a co-dopant was the ReO{sub 4{minus}} resonance observed. The absorption, detected as a very weak resonance through a 92 mm path length, was centered at 946.0 cm{sup {minus}1} with linewidth of 5 cm{sup {minus}1} with linewidth of 5 cm{sup {minus}1}, overlapping the P(20) transition in the 10 micron CO{sub 2} band. 6 refs., 10 figs.

49121 (LA-UR—88-2264) **Theory of 3-D structure and intrinsic defects of trans-polyacetylene.** Vogl, P.; Campbell, D.K.; Sankey, O.F. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-880669—12). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88014324/JAW.

From International conference on science and technology of synthetic metals; Santa Fe, NM, USA (26 Jun 1988).

First-principles local-density functional pseudopotential calculations of static and dynamic electronic structure properties of crystalline 3-D trans-(CH){sub x} are reported. The P2{sub 1}/a structure is predicted to have a lower energy than the P2{sub 1}/n structure. A Green function calculation reveals that the 3-D character of the electronic band edge states destabilizes polarons and bipolarons and prevents self-trapping in perfectly ordered 3-D trans-(CH){sub x}. 3 figs., 29 refs.

49122 **(LA-UR—88-2405) Lunar concrete for construction.** Cullingford, H.S.; Keller, M.D. (National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center; Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-8804104—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014391/JAW.

From NASA symposium on lunar bases and space activities of the 21st century; Houston, TX, USA (5 Apr 1988).

Feasibility of using concrete for lunar-base construction has been discussed recently without relevant data for the effects of vacuum on concrete. Our experimental studies performed earlier at Los Alamos have shown that concrete is stable in vacuum with no deterioration of its quality as measured by the compressive strength. Various considerations of using concrete successfully on the moon are provided in this paper along with specific conclusions from the existing data base. 10 refs., 3 figs., 2 tabs.

49123 **(LBL—25173) Microstructural study of an iron silicate catalyst using electron microscopy.** Csencsits, R.; Gronsky, R. (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract AC03-76SF00098. 10p. (CONF-880939—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88010785/JAW.

From Symposium on preparation and characterization of catalysts; Los Angeles, CA, USA (25 Sep 1988).

The effects of various synthesis conditions on the structure of iron silicate analogs of zeolite ZSM-5 were considered. Scanning electron microscopy (SEM) was used to determine the particle size distributions and morphologies. Particle sizes vary from tenths of a micron to several microns, depending on degree of agitation during crystal growth, while morphology is additionally dependent on the concentration of iron in the gel during crystallization. Transmission electron microscopy (TEM) was used to determine the size and spatial distributions of iron-rich second phase particles within the ZSM-5 framework as a function of SiO_2/Fe_2O_3-ratio, thermal hydrothermal treatments. 6 refs., 4 figs.

49124 **(N—88-22097) Interlaminar fracture toughness of thermoplastic composites.** Hinkley, J.A.; Johnston, N.J.; Obrien, T.K. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Feb 1988. 33p. (NASA-TM—100532; NAS—1.15:100532; USAAVSCOM-TM—88-B-002). NTIS, PC A03/MF A01.

Edge delamination tension and double cantilever beam tests were used to characterize the interlaminar fracture toughness of continuous graphite-fiber composites made from experimental thermoplastic polyimides and a model thermoplastic. Residual thermal stresses, known to be significant in materials processed at high temperatures, were included in the edge delamination calculations. In the model thermoplastic system (polycarbonate matrix), surface properties of the graphite fiber were shown to be significant. Critical strain energy release rates for two different fibers having similar nominal tensile properties differed by 30 to 60%. The reason for the difference is not clear. Interlaminar toughness values for the thermoplastic polyimide composites (LARC-TPI and polyimidesulfone) were 3 to 4 in-lb/sq in. Scanning electron micrographs of the EDT fracture surfaces suggest poor fiber/matrix bonding. Residual thermal stresses account for up to 32% of the strain energy release in composites made from these high-temperature resins.

49125 **(NP—8770363) Effects of fly ash additives on the strength of concrete from blast furnace cement with high concentrations of metallurgical sand.** Manns, W.; Neubert, B. (Forschungs- und Materialpruefungsanstalt Baden-Wuerttemberg (FMPA), Stuttgart (Germany, F.R.)). 30 Jul 1987. 45p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770363/JAW.

The pilot study comprised mechanical and technological comparative investigations of concretes from blast furnace cement with metallurgical sand on the one hand and concretes with part of the blast furnace cement replaced by fly ash from a melting chamber furnace on the other hand. The applicability of fly ash as a concrete binder was established in principle.

49126 **(ORNL/Sub—84-7802/1) Development of a theory of wear of ceramics: Final report.** Winer, W.O.; Ting, B.-Y. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015327/JAW.

This report covers the first three years of the contract entitled "Development of a Theory of Wear of Ceramics" (DOE–ORNL Project Authorization {number←sign}19x-15, Basic Agreement No. 7802). The research work carried out during this period includes: (1) the exploration of the hotspots and the triboluminescence generated by a sliding contact between a sapphire disk and ceramic pins, (2) the use of an infrared scanning system (AGA Thermovision 750) to measure the contact temperature between a sappphire disk and ceramic pins, (3) installing a new infrared scanning system (Inframetrics model 525) with a digital video processor (Quantex DS50) and a computer for temperature measurement, (4) preliminary wear measurements under a controlled environment for a PSZ pin sliding against a sapphire disk, (5) measurements of mean wear depth of hotspots of Si3N4 sliding against sapphire, and (6) developing a thermomechanical wear theory. These topics will be discussed respectively below. 11 ref., 14 figs., 12 tabs.

49127 **(PB—88-219316/XAB) Surface treatment of refractory fibers. Final report.** Odorico, J.; Renard, P. (Societe Nationale Industrielle Aerospatiale, 92 - Suresnes (France). Lab. Central). 9 Oct 1987. 57p. (In French). (PROCES-VERBAL—47/803/F). NTIS, PC E04/MF E04.

This study discusses the conditions of depositing coatings of 5 substances - Al_2O_3, Y_2O_3, ZrO_2 stabilized CaO, Nb_2O_5 and Nb - obtained by cathodic magneton RF pulverization. The authors implemented a device capable of thread coating a fiber mesh of approximately 10 m. The preliminary tests of Nb_2O_5 deposition on carbon mesh of 10,000 filaments have proven to be very encouraging. The authors coated for ONERA and Aerospatiale CSi fibers with Nb_2O_5 of a thickness of approximately 5000 A and a length supplied of approximately 10 m.

49128 **(SAND—87-2580C) Microsoldering and microminiature welding with lasers.** Jellison, J.L.; Keicher, D.M. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 15p. (CONF-8809104—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013368/JAW.

From Mucrojoining '88; Cambridge, UK (20 Sep 1988).

Miniature welding of electronic and electromechanical components with lasers is a rapidly maturing technology. Extending the use of lasers to microsoldering and microminiature welding applications has also generated moderate interest. Use of lasers for microminiature soldering or welding permits the delivery of accurately controlled amounts of heat to the precise area required. By applying small amounts of heat locally, rework can be accomplished in densely packed circuits without damaging heat sensitive components to conductors. Also, localization of heat obviates the need for using solder alloys of different melting points, which can simplify design. Laser soldering has been applied to conductors ranging from 25 μm dia. wires to coaxial cables in the 0.3 to 1.25 mm range. For the most part, these conductors were soldered to metallized alumina substrates, although in some instances soft substrates were also used. The potential advantages of microminiature welding have also been explored. 9 refs., 6 figs., 1 tab.

49129 **(SAND—88-0777) Coefficients of thermal expansion of common encapsulants.** Adolf, D.B. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015026/JAW.

The coefficient of thermal expansion (CTE) of common electronic encapsulating polymers were measured over the temperature range of {minus} 50{degree}C to approximately 120{degree}C. CTE's are presented for these systems as continuous functions of temperature in contrast to previous measurements. Comparison between the historical " property chart" CTE's and those obtained in this study are made when possible. The procedures used in this study are presented in detail so that, unlike the

property chart, users will fully understand the accuracy and limitations of these values. 27 figs., 5 tabs.

49130 **(SAND—88-0857C) A strain rate dependent brittle fracture model based on continuum damage mechanics.** Chen, E.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 27p. (CONF-8805161—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013361/JAW.

From Workshop on dynamic constitutive/failure models for use in computer codes; Dayton, OH, USA (9 May 1988).

Dynamic fracturing in brittle materials is studied in the present investigation using a strain rate dependent continuum damage model. A basic assumption of this model is the existence of a randomly distributed crack network in the material. Under applied tension, these cracks will grow and interact to relieve the stress. This is reflected globally by reducing the stiffness of the material. In compression, the material responds in an elastic/perfectly plastic manner. Explicit strain rate dependence has been included in the model. A brief description of the model will be given. Applications of the model to treat engineering scale problems will be discussed. 13 refs., 16 figs.

49131 **(SAND—88-1121C) Microporous polymer foams for biomaterials.** Aubert, J.; Sylwester, A.; Rand, P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-880912—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010578/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

A variety of microcellular foams were prepared for use in the fabrication of targets for inertial confinement fusion and pulsed driven x-ray lasers. The process consists of three steps. First a polymer and solvent are heated above their critical temperature to achieve a homogenous polymer solution. Next, the solution is quenched in a controlled fashion, usually within a mold. Quenching results in the formation of bi-continuous phases: a polymer-rich phase and a solvent-rich phase. Once phase separation has occurred, the solution can be frozen or alternatively with certain polymers the solution may form a stable gel. In the final step, the solvent is removed by sublimation of the frozen solvent or by liquid extraction of a resulting gel leaving behind a microcellular polymer foam. By controlling the phase separation during the quench, the foam morphology and pore size can be varied. 8 refs., 4 figs.

49132 **(SAND—88-1347C) Carbon films derived from poly(acrylonitrile): Oxidation, electrical properties, and processing.** Renschler, C.L.; Salgado, L.V. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 8p. (CONF-880912—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010352/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

Carbon films made by pyrolytic decomposition of PAN poly(acrylontrile) can be made with controlled electrical conductivity by varying the final temperature of pyrolysis. Further, the conductivity is a function of precursor structure, with lower PAN content yeilding lower conductivity. The gas phase oxidation proceeds through an intermediate surface oxidation, with an activation energy of ca. 33 kcal/mol. Films made in this way can be patterned using photolithography and oxygen etching; transfer of films from one substrate to another is accomplished with either dry or wet transfer techniques. 13 refs., 3 figs.

49133 **(UCID—21459) PINEX [Pinhold Neutron Experiment] fluor characteristics.** Koehler, H.; Kammeraad, J.; Davis, B.; Burns, E. (Lawrence Livermore National Lab., CA (USA)). 1 Jul 1988. Contract W-7405-ENG-48. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014699/JAW.

This report will describe recent experiments to characterize four fluors: BC-400, 408, 422, 430. Each fluor sample was 0.5 cm thick commensurate with our standard Electronic Pinhole Neutron Experiment (EL-PINEX) fluors. The important results are that the neutron-gamma sensitivity ratios did not change significantly, although the absolute gamma and neutron sensitivities decreased. 6 figs., 4 tabs.

49134 **Trap suppression by isoelectronic In or Sb doping in Si-doped n-GaAs grown by molecular-beam epitaxy.** Li, A.Z.; Kim, H.K.; Jeong, J.C.; Wong, D.; Schlesinger, T.E.; Milnes, A.G. (Department of Electrical and Computer Engineering, Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213). *Journal of Applied Physics;* **64**: No. 7, 3497-3504(1 Oct 1988).

The effects of isoelectronic doping of GaAs by In or Sb on the electron deep levels in n-GaAs grown by molecular-beam epitaxy have been investigated in the growth temperature range 500—600 °C for Si doping levels of 4—7 x 10^{16} cm^{-3} and As-stabilized conditions. The two dominant traps M3 and M6 are drastically reduced in concentration by up to three orders of magnitude for M3 (from 10^{15} cm^{-3} down to $<10^{12}$ cm^{-3}) and two and a half orders of magnitude for M6 by introducing 0.2—1 at.% In or Sb and increasing growth temperatures from 500 to 550 °C. The trap concentrations of M3 and M6 were also significantly reduced by increasing the growth temperature to 600 °C without In or Sb doping and by decreasing the growth rate from 1.0 to 0.3 μm/h. The incorporation coefficients of In and Sb have been measured and are found to decrease with increasing growth temperature. The growths with high M3 and M6 trap densities are shown to have short minority-carrier diffusion lengths. Indium isoelectronic doping, which is presumed to take place on a gallium sublattice site, and Sb doping, which is expected to take place on an arsenic sublattice site, appear to have rather similar effects in suppressing the concentration of the M3 and M6 electron traps. This suggest that both of these traps are in some way related to (V/sub As/V/sub Ga/) complexes or (V/sub As/XV/sub Ga/) complexes where X is different for M3 and M6 and might be interstitial or impurity related.

49135 **Measurement of electron diffusion lengths in ITO/p-InP by surface photocurrents.** Hanak, T.; Ahrenkiel, R.K. (Solar Energy Research Institute, Golden, Colorado 80401). *Journal of Applied Physics;* **64**: No. 7, 3528-3531(1 Oct 1988).

The electron diffusion length is deduced in n-indium tin oxide/p-InP heterojunctions by a short-circuit photocurrent technique. The technique involved the nonlinear least-squares fit of the photocurrent and junction capacitance to a simple model. The absorption coefficient of the monochromatic light is also produced by the fit. This produces an electron effective diffusion length in the p-InP which varies from about 1.0 μm for highly absorbed light up to about 8.0 μm for deeply penetrating light.

49136 **Spectral hole burning in polysilanes.** Trommsdorff, H.P.; Zeigler, J.M.; Hochstrasser, R.M. (Laboratoire de Spectrometrie Physique, associe au C.N.R.S. Universite Joseph Fourier, Grenoble I, B.P. 87, 38402 St. Martin d'Heres Cedex, France). *Journal of Chemical Physics;* **89**: No. 7, 4440-4441(1 Oct 1988).

The first observation of hole burning in the optical spectra of delocalized polymer backbone states is reported. The polymer chosen for this study is poly-(di-n-hexyl)-silane, consisting of chains of roughly 5100 silicon atoms. Absorption spectra of polysilane in solution at 1.6K and 77K are reported.(AIP)

49137 **Electron-spin-resonance study of radiation-induced paramagnetic defects in oxides grown on (100) silicon substrates.** Kim, Y.Y.; Lenahan, P.M. (Department of Electrical Engineering, The Pennsylvania State University, University Park, Pennsylvania 16802). *Journal of Applied Physics;* **64**: No. 7, 3551-3557(1 Oct 1988).

We have used electron-spin resonance to investigate radiation-induced point defects in Si/SiO_2 structures with (100) silicon substrates. We find that the radiation-induced point defects are quite similar to defects generated in Si/SiO_2 structures grown on (111) silicon substrates. In both cases, an oxygen-deficient silicon center, the E' defect, appears to be responsible for trapped positive charge. In both cases trivalent silicon (P/sub b/ centers) defects are primarily responsible for radiation-induced interface states. In earlier electron-spin-resonance studies of unirradiated (100) substrate capacitors two types of P/sub b/ centers were observed; in oxides prepared in three different ways only one of these centers, the P/sub b/₀ defect, is generated in large numbers by ionizing radiation.

49138 Real-time observations of hydrogen drift and diffusion in silicon. Seager, C.H.; Anderson, R.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **53**: No. 13, 1181-1183(26 Sep 1988).

Real-time detection of hydrogen motion and bonding has been accomplished by capacitance voltage profiling of various Schottky and metal- insulator-semiconductor capacitors during low-energy H ion beam injection into the barrier metallization. Finite element analysis modeling of the data indicates that a significant fraction of H interstitials are positively charged, and that bonding of these species with charged boron acceptors proceeds with the large cross section expected of a Coulomb capture process. The 300 K value of the H diffusivity is $\simeq 10^{-10}$ cm²/s in agreement with extrapolation of high-temperature diffusivity data.

49139 Pressure dependence of the DX center in Ga/sub 1-//sub x/Al/sub x/As:Te in the vicinity of the Γ-X crossover. Li, M.F.; Shan, W.; Yu, P.Y.; Hansen, W.L.; Weber, E.R.; Bauser, E. (Department of Physics, University of California, Berkeley, California 94720, and Materials and Chemical Science Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Applied Physics Letters;* **53**: No. 13, 1195-1197(26 Sep 1988).

The pressure dependence of the DX center in Ga/sub 1-// sub x/Al/sub x/As :Te has been studied in two samples with x = 0.15 and 0.35, respectively. The pressure coefficients of the activation energies for both emission and capture were found to change sign when the band gap of GaAlAs changes from direct to indirect. These results, together with previous experiments, suggested that electrons can be emitted from and capture into the DX centers via both L and X valleys.

49140 Realistic modeling of the electronic properties of doped amorphous silicon. Hack, M.; Street, R.A. (Xerox Palo Alto Research Center, Palo Alto, California 94304). *Applied Physics Letters;* **53**: No. 12, 1083-1085(19 Sep 1988).

In this letter we describe a fundamental approach to calculating the electronic properties of doped amorphous silicon which takes into account the thermal history of the material. Above the equilibrium temperature, the material is in a thermodynamically stable state, and this is derived by minimizing the free energy using a simple density of states model. The calculations are based on the defect compensation model of doping, introducing distributions of formation energies for neutral dangling bonds and fourfold dopant atoms while preserving charge neutrality. Our results are in good agreement with experimental data providing a realistic model for use in device simulation programs.

49141 Electrical and optical studies of dislocation filtering in InGaAs/GaAs strained-layer superlattices. Fritz, I.J.; Gourley, P.L.; Dawson, L.R.; Schirber, J.E. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **53**: No. 12, 1098-1100(19 Sep 1988).

We report electrical transport and optical studies of the efficiency with which an In/sub 0.2/Ga/sub 0.8/As/GaAs strained-layer superlattice (SLS) can filter threading dislocations generated in a thick In/sub 0.1/ Ga/sub 0.9/ As layer grown on GaAs. The electrical studies, the first of their kind, rely on a novel test structure which allows electrical characterization of just the top portion of the SLS, with the bottom portion acting as the dislocation filter. For optical characterization we detect dislocations directly by photoluminescence microscopy. The electrical results show that ~3—6 periods of filtering are needed to attain high mobilities. The photoluminescence microimages show a small density of dislocations near the top of an eight-period SLS but no dislocations for 11 or more periods. Filtering with In/sub 0.2/Ga/sub 0.8/As/GaAs SLS's is more effective than with GaAs/sub 0.8/P/sub 0.2//GaAs SLS's, possibly because of larger interlayer differences in strain and elastic constants for the former.

49142 Response to "Comment on 'Relaxation of strained-layer semiconductor structures via plastic flow' " [Appl. Phys. Lett. 53, 1127 (1988)]. Dodson, B.W.; Tsao, J.Y. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **53**: No. 12, 1128-1128(19 Sep 1988).

In response to the Comment of Strained-Layer Semiconductor Structures Plastic Flow , we would like to point out that one of us has developed an approximate solution for the plastic flow model which interpolates between the Matthews-Blakeslee expression for thermodynamic critical thickness and the People-Bean expression for large amounts of relaxation, and that Peopl e's comment that high resolution studies of relaxation in the SiGe/Si system are lacking is not quite correct. (AIP)

49143 Capillary waves on the surface of simple liquids measured by x-ray reflectivity. Braslau, A.; Pershan, P.S.; Swislow, G.; Ocko, B.M.; Als-Nielsen, J. (Department of Physics and Division of Applied Sciences, Harvard University, Cambridge, Massachusetts 02138). *Physical Review [Section] A: General Physics;* **38**: No. 5, 2457-2470(1 Sep 1988).

The properties of the liquid-vapor interface for three simple liquids (water, carbon tetrachloride, and methanol) have been measured using x-ray reflectivity. The measured surface roughness is interpreted using a model that combines the effects of thermally induced capillary waves and the dimensions of the constituent molecules.

49144 Oxidation of Si implanted with nondopant, metallic ions. Holland, O.W.; White, C.W.; Pennycook, S.J. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Journal of Materials Research;* **3**: No. 5, 898-906(Sep 1988).

The effect of implantation of low-solubility, metallic impurities into Si on the oxidation kinetics in steam was studied. The list of impurities that were studied include Ti, Co, Ni, Fe, Yb, Pb, Sn, and Ag. Kinetic data from Pb^+-implanted Si is correlated with the impurity behavior during the oxidation. It will be shown that the oxidation rate is dependent both on the impurity segregation phenomena at the oxide/Si interface and on the nature of the ion-induced damage that is stable at the oxidation temperature. Also, it is shown that novel morphologies can develop in the Si substrate during oxidation. Transmission electron microscopy and Rutherford backscattering/channeling spectroscopy were used to characterize these structures. Mechanisms responsible for the morphological changes in the substrate during oxidation are discussed.

49145 Porous fluoride antireflective coatings. Thomas, I.M. (University of California, Lawrence Livermore National Laboratory, P.O. Box 5508, Livermore, California 94550). *Applied Optics;* **27**: No. 16, 3356-3358(15 Aug 1988).

Quarterwave antireflective coatings of CaF_2 and MgF_2 have been prepared on fused silica and calcium fluoride substrates from colloidal suspensions of the relevant fluorides in methanol. These coatings have high optical efficiency and laser damage thresholds at 350 nm in the 6–8-J/cm² range for single shots of 0.6-ns pulse length and 20–25 J/cm² for 25-Hz multishots of 25-ns pulse length.

49146 Crystal-field anisotropy in the magnetic susceptibility of single-crystal $CfCl_3$. Nave, S.E.; Hart, R.C.; Wilmarth, W.R.; Haire, R.G.; Peterson, J.R. (Department of Physics, University of Tennessee, Knoxville, Tennessee 37996-1200). *Physical Review [Section] B: Condensed Matter;* **38**: No. 4, 2695-2702(1 Aug 1988).

The magnetic susceptibilities of polycrystalline samples of $CfCl_3$ in both the hexagonal (UCl_3 type) and orthorhombic ($PuBr_3$ type) crystal structures as well as of single-crystal samples of the hexagonal structure have been measured. Measurements were performed at temperatures between 4.4 and 340 K and in magnetic fields of up to 50 kG. Above 100 K, the polycrystalline samples exhibit Curie-Weiss behavior with an effective paramagnetic moment of 10.2μ/sub B/, which is in agreement with an intermediate-coupling model of the electronic structure. Both structures also show metamagnetic behavior with Neel temperatures of 7 and 13 K for the hexagonal and orthorhombic structures, respectively. Single crystals of the hexagonal form of $CfCl_3$ were grown using a modified Bridgman technique. The measured anisotropy in the magnetic susceptibility is consistent with the anisotropy due to the crystal-field splitting, as determined from optical-absorption measurements, if the effects of the antiferromagnetic ordering are included. Magnetization measurements at 4.4 K, as a function of magnetic field up

to 50 kG, are also consistent with the electronic wave functions and energies predicted by optical-absorption spectroscopy.

49147 **Sintering aid for lanthanum chromite refractories.** Flandermeyer, B.K.; Poeppel, R.B.; Ellyn, G.; Dusek, J.T.; Anderson, H.U. (to Dept. of Energy, Washington, DC). US Patent 4,749,632. 7 Jun 1988. Filed date 23 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A method of forming an electronically conductive, integral layer including lanthanum chromite is described comprising: depositing a layer including particulate lanthanum chromite containing a minor fraction of a sintering acid which includes a eutectic affording composition of at least two components providing a minor portion of a liquid phase in the layer during the sintering step, and eutectic affording composition having a melting point substantially below the melting point of the lanthanum chromite; sintering the layer at a sufficiently high temperature of not more than 1800°K to form and densify an integral layer including lanthanum chromite.

49148 **Confined ion beam sputtering device and method.** Sharp, D.J. (to Dept. of Energy, Washington, DC). US Patent 4,747,922. 31 May 1988. Filed date 25 Mar 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A confined ion beam sputtering device is described comprising: a hollow cylindrical target having at least an inner wall surface of material selected for ion sputtering; a substrate supported within and electrically insulated from the cylindrical target; a first ion beam source means at one end of the cylindrical target for generating a first ion beam and directing the beam axially into the hollow cylindrical target toward the substrate; first biasing means for electrically biasing the substrate; and second biasing means for electrically biasing the cylindrical target independent of the first biasing means; whereby ions entering the cylindrical target may be electrically deflected circumferentially to impinge on the inner wall surface of the target at acute angles for efficiently sputtering material therefrom for deposit on the substrate.

40 CHEMISTRY

REFER ALSO TO CITATION(S) 48715

49149 **(ORNL—6481) Chemistry Division annual progress report for period ending March 31, 1988.** (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 218p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88015324/JAW.

The research is divided into the following areas: coal chemistry, aqueous chemistry at high temperatures and pressures, geochemistry of crystal processes, chemistry of advanced inorganic materials, structure and dynamics of advanced polymeric materials, chemistry of transuranium elements and compounds, chemical and structural principles of solvent extraction, reactions and catalysis in molten salts, surface science related to heterogeneous catalysis, electron spectroscopy, chemistry related to nuclear waste disposal, computational modeling of security document printing, and special topics.

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 48193, 48195, 48196, 48273, 48321, 48379, 49115, 49212, 49212, 49445, 49461, 49489, 49552, 49586, 49828, 50009, 50241, 50243

49150 **(AD-A—193206/0/XAB) Ultratrace detection of chemical warfare agent simulants using supersonic-molecular-beam, resonance-enhanced multiphoton-ionization, time-of-flight mass spectroscopy. Final report.** Syage, J.A.; Pollard, J.E.; Cohen, R.B. (Aerospace Corp., El Segundo, CA (USA). Aerophysics Lab.). 15 Feb 1988. 142p. (TR—0086A(2908)-1). NTIS, PC A07/MF A01.

An ultratrace detection method that offers exceptional selectivity has been developed based on the technique of supersonic molecular beam, resonance enhanced multiphoton ionization, time-of-flight mass spectroscopy (MB/REMPI/TOFMS). Single ion detection capability has given detection limits as low as 300 ppt (dimethyl sulfide). Single vibronic level REMPI of the supercooled molecules in conjunction with TOFMS provides selectivity of 10,000 against chemically similar compounds. Studies were carried out using moist air expansions for a variety of organophosphonate and sulfide chemical warfare agent (CWA) simulant molecules. The preparation of molecules in single vibronic levels by laser excitation in supersonic molecular beams has enabled us to record high resolution spectra of higher excited electronic states showing fully resolved vibrational structure for diisopropyl methylphosphonate (DIMP) and dimethyl sulfide (DMS). VUV absorption spectra have also been recorded for several CWA molecules at ambient temperature, revealing several new electronic states extending up to the ionization threshold.

49151 **(AD-A—193255/7/XAB) Multiphoton ionization mass spectrometry.** Lubman, D.M. (Michigan Univ., Ann Arbor (USA). Dept. of Chemistry). 1987. 30p. NTIS, PC A03/MF A01.

Pub. in Progress in Analytical Spectroscopy, Vol. 10, 529-559(1987).

The advent of high-peak-power tunable visible- and ultraviolet-laser sources has made multiphoton ionization processes feasible. The multiphoton ionization technique (MPI) depends upon the absorption of two or more photons by a molecule upon irradiation with an intense visible or ultraviolet light source. The truly unique property of MPI spectroscopy is that it can be used as a means of achieving spectral selection of a compound prior to mass analysis. There are several different ways in which MPI can be induced. The MPI method that has found most extensive application in analytical chemistry is resonant two-photon ionization (R2PI). In this process, one photon excites a molecule to an excited electronic state, and a second photon ionizes the molecule.

49152 **(AD-A—193701/0/XAB) Laser-induced double resonance ionic fluorescence of rare earths in the inductively coupled plasma.** Tremblay, M.E.; Simeonsson, J.B.; Smith, B.W.; Winefordner, J.D. (Florida Univ., Gainesville (USA). Dept. of Chemistry). 1988. 7p. NTIS, PC A02/MF A01.

Pub. in Applied Spectroscopy, Vol. 42, No. 2, 281-285(1988).

Laser Excitation of ionic fluorescence overcomes the problem of spectral interferences encountered when trace analysis of the rare earths is performed by atomic/ionic emission spectrometry in the inductively coupled plasma. Two pulsed, excimer-pumped, tunable dye lasers are used to excite ionic fluorescence of rare earths in an inductively coupled plasma. Since several fluorescence lines were observed after laser excitation, it is possible to draw partial energy-level diagrams for lanthanum, ytterbium, europium, and lutetium.

49153 **(CEA-CONF—9334) Rapid and simple gas chromatographic analysis of carbon dioxide, hydrogen sulfide and water vapor in methane.** Valin, F.; Egret, J.; Botter, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie). 1987. 14p. (CONF-870954—2). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754260/JAW.

From EUROANALYSIS VI: European conference on analytical chemistry; Paris, France (7 Sep 1987).

The present method has been developed for the study of the dehydradation of a petroleum gas by gas permeation. A rapid and simple measurement of water vapor in methane containing also CO/sub 2/ and H/sub 2/S has been realized. A gas chromatographic separation using two columns in series is proposed. A Porapak R column enables a separation of H/sub 2/S and H/sub 2/O in such conditions that the CO/sub 2/-CH/sub 4/ mixture will be well separated in a second Porapak Q column, without distorsion of H/sub 2/S and H/sub 2/O peaks. The optimized conditions are the following: helium carrier gas (25 cm/sup 3/ NTP per minute), first Porapak R column (30 cm length, 3.2 mm inside diameter), second Porapak Q column (75 cm, 3.2 mm). Both columns are operated first at 40/sup 0/C for 1 minute, then heated linearly at 45/sup 0/C/minute up to 110/sup 0/C, and at constant 110/sup 0/C temperature. In these conditions, the corrected retention times of CH/sub 4/, CO/sub 2/, SH/sub 2/ and H/sub 2/O are respectively of 0.12,

0.5, 2 and 2.6 minutes. The detection is performed by thermal conductivity and the calibration found linear for all the constituents. The analysis is completed in 4 minutes and enables the detection of respectively 100, 150 and 300 v.p.m. of CO/sub 2/, H/sub 2/S and H/sub 2/O in 1 cm/sup 3/ of petroleum gas. This simple method can be easily adapted on a commercial chromatograph.

49154 **(DOE/ER/13256—4) [Continuous chemical reaction chromatography]: Progress report.** (Minnesota Univ., St. Paul (USA)). [1988]. Contract FG02-84ER13256. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013755/JAW.

The theoretical and experimental study of the countercurrent moving-bed chromatographic reactor was completed, including the catalytic hydrogenation of 1, 3, 5-trimethylbenzene. The countercurrent moving bed was also studied. A simulated countercurrent moving bed was built and used to separate propylene-dimethyl ester mixtures. Mathematical models were made. (DLC)

49155 **(DOE/OR/00033—T409) The structure of normal ionic micelles by interpretation of small-angle neutron scattering data from selectively labeled (^2H, ^{19}F) surfactant solutions.** Berr, S.S. (Wake Forest Univ., Winston-Salem, NC (USA). Dept. of Chemistry). Dec 1986. Contract AC05-76OR00033. 258p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88015642/JAW.

We have determined the structure of micelles formed in water by several classes of ionic surfactants under a variety of experimental conditions using small-angle neutron scattering (SANS) techniques. Contrast between the micelles and the solvent was achieved through either selective deuteration or fluorination of the surfactant, or through the use of D_2O. Interpretation of SANS data was facilitated by the use of Hayter, Penfold, and Hansen's rescaled Mean Spherical Approximation theory to calculate the scattering due to interparticle interactions. We have devised a number of micelle models, both spherical and ellipsoidal, to account for the scattering due to single micelles. It was found that changing the solvent from H_2O to D_2O results in the formation of larger micelles due to changes in the solvent-surfactant hydrocarbon interactions. This solvent isotope effect increased as the length of the alkyl chain increased. The fractional micellar charge did not change with respect to isotopic composition of solvent. We found that alkyltrimethylammonium bromide surfactants form drier micelles than do the sodium alkyl sulfate surfactants of equal chain length. Also, all micelles studied were found to be dry near the critical micelle concentration (cmc) and to become increasingly wetter as the concentration increased. The increase in aggregation number with respect to the square root of surfactant concentration was found to be linear for all systems studied. 80 figs.

49156 **(EGG—10282-2145) Total organic carbon and gas chromatography: Mass spectroscopic methods to determine total carbon and hydrocarbons in mercuric iodide single crystals.** Steinberg, S.; Kaplan, I.; Schieber, M..; Ortale, C.; Skinner, N.; van den Berg, L. (Global Geochemistry Corp., Canoga Park, CA (USA); EG and G, Inc., Goleta, CA (USA). Santa Barbara Operations). 1987. Contract AC08-83NV10282. 27p. (CONF-8709315—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014982/JAW.

From 6. international workshop on compound semiconductors for room temperature X-ray and nuclear detectors; Davos, Switzerland (14 Sep 1987).

Total organic carbon was by measuring the CO_2 produced by combustion in a sealed quartz vessel. The CO_2 was quantified by nondispersive IR and by titration using commercial detectors. The total organic carbon was found to be around 10 to 100 $\mu g/g$ in both starting materials and in single crystals. Gas chromatography--mass spectroscopy (GC/MS) measurements were made hexane extracts of mercuric iodide (HgI_2) dissolved in potassium iodide solution. Hydrocarbons starting with C_{10} (DIENE) and up to C_{26} were found. In addition, phthalates, such as diethyl and dioctyl phthalate were also found. Some of the organic compounds, for example, such hydrocarbons as branched nC_{16}, nC_{20}, nC_{21}, nC_{22}, nC_{23}, and nC_{24}, were present in some HgI_2 materials in quantities of the order of weight ppM, but were eliminated in the purification process and were not found in the single crystals. Other organic compounds such as the phthalates were not always eliminated and were identified in the single crystals. In general, the GC/MS could identify only hydrocarbons of C_{10} and higher could account for few percentages of the total organic carbon determined by oxidation. 10 refs., 7 figs., 4 tabs.

49157 **(GKSS—88/E/3) Prompt γ-ray neutron activation analysis of river sediments.** Spychala, M.; Michaelis, W.; Fanger, H.U. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). 1988. 10p. Special print from Nucl. Geophys. (1987) v. 1(4) p. 309-317.

At the reactor FRG-1 of the GKSS Research Centre a prompt γ-ray neutron capture facility with a 5 detector pair spectrometer has been installed. The paper describes the application of this instrument to the analysis of river sediments laying particular emphasis on two aspects: (1) The detection of toxic trace elements such as Cd and Hg and (2) the characterization of the sample with respect to its main constituents. A simple, but efficient calibration procedure is presented and substantiated by reference analyses.

49158 **(GKSS—88/E/7) Prompt gamma-ray neutron activation analysis for multi-element determination in sediment samples.** Spychala, M.; Michaelis, W.; Fanger, H.U. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). 1988. 10p. Special print from J. Radioanal. Nucl. Chem., Articles (1987) v. 112(2) p. 331-339.

A facility for the irradiation of internal targets has been installed at the research reactor FRG-1 of the GKSS Research Center. Thermal-neutron induced prompt gamma radiation was detected by a pair spectrometer. With this experimental arrangement concentrations of the major and minor elements Na, Al, Si, K, Ca, Ti, Mn, Fe, Zn, Cl, and S, as well as of the trace constituents Cr, Ni, Cu, Cd, and Hg of samples from a sediment core of the Elbe river could be determined. The results indicate that prompt gamma-ray neutron activation analysis (PGNAA) is a powerful instrumental tool for a complete characterization of the main sediment constituents and for the detection of the trace elements Cd and Hg which are of considerable ecological relevance.

49159 **(GKSS—88/E/8) Capability of the 14 MeV neutron activation analysis at 3x10/sup 10/ x cm/sup -2/ x s/sup -1/ with respect to sensitivities and interferences of all useful reactions.** Pepelnik, R. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). 1988. 19p. Special print from J. Radioanal. Nucl. Chem., Articles (1987) v. 112(2) p. 435-452.

A comprehensive study of the sensitivity of 14 MeV NAA has been carried out. Consideration was given to all potentially useful reactions in order to find those with sufficient sensitivity and minimal interference. The results allow selection of the optimum reactions for determination of correct elemental concentrations.

49160 **(IAEA-AL—003) JASPAS programme task JC-4: Isotopic and isotope dilution analysis of spent fuel solutions by resin bead mass spectrometry. Results of the sixth interlaboratory experiment.** Hayashi, N.; Terakado, S.; Kuno, Y. and others. (Power Reactor and Nuclear Fuel Development Corp., Tokai (Japan). Tokai Reprocessing Plant). (International Atomic Energy Agency, Vienna (Austria)). May 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703964/JAW.

The use of resin beads for mass spectrometry of U and Pu has been extensively developed at Oak Ridge National Laboratory

in the USA and tested in a number of intercomparison experiments between the Safeguards Analytical Laboratory (SAL) of the IAEA and the Power Reactor and Fuel Development Corporation (PNC) - Tokai Reprocessing Plant (TRP) in Japan. Resin beads represent a convenient way to concentrate the U and Pu in spent fuel dissolver solution samples from reprocessing facilities, with the added advantage that fission product elements and other actinides such as Am are removed. Measurements on the resin bead samples at SAL were performed on the ORNL-designed 2-Stage Mass Spectrometer. For the dried tracer samples, the U measurements were obtained on the VG54E instrument and the Pu results were obtained with the Finnigan MAT 261 of SAL. PNC/TRP used a VG54 mass spectrometer and obtained their mass fractionation correction factor for the resin bead measurements from the mixed tracer plus chemical standard resin bead samples. The Safeguards Laboratory (NMCC) used their MAT 260 instrument and obtained the fractionation correction factor from resin bead standards provided with the TIGR-82 programme. Both PNC/TRP and NMCC reported problems with obtaining a sufficient ion beam intensity with the resin bead samples. This problem was overcome by both labs and further improvements in the loading and measurement techniques can be expected to yield even better results. It has been demonstrated that the resin bed sampling method can provide results of sufficient quality for safeguards purposes. 2 refs, 3 figs, 16 tabs.

49161 **(IAEA-STR—240) Gaseous isotope correlation technique for safeguards at reprocessing facilities.** Ohkubo, Michiaki. (International Atomic Energy Agency, Vienna (Austria). Dept of Safeguards). Mar 1988. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703966/JAW.

The isotope correlation technique based on gaseous stable fission products can be used as a means of verifying the input measurement to fuel reprocessing plants. This paper reviews the theoretical background of the gaseous fission product isotope correlation technique. The correlations considered are those between burnup and various isotopic ratios of Kr and Xe nuclides. The feasibility of gaseous ICT application to Pu input accountancy of reprocessing facilities is also discussed. The technique offers the possibility of in situ measurement verification by the inspector. (author). 16 refs, 7 figs.

49162 (INIS-BR—1147-Vol.1, pp 211-220) **Measurement of uranium enrichment by irradiation with 14 MeV neutrons.** Souza, R.M.G.P.; Rezende, H.R. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A non-destructive technique for the determination of uranium in UO/sub 2/ samples was developed, making use of the change in the fission cross section of a nuclide with the neutron energy. The active interrogation method was used by irradiating the samples with pulsed 14 MeV neutrons and further detection of delayed fission neutrons. In order to discriminate U-238 from U-235 the neutron energy was tailored by means of two concentric cylinders of lead and paraffin/poliethylene, 11 and 4 cm thick. Between neutron pulses, delayed neutrons from fission were detected by a long counter built with five BF/sub 3/ proportional counters. Calibration curve for enrichment versus delayed neutron response was obtained using available UO/sub 2/ pellets of known enrichments.

49163 (INIS-BR—1147-Vol.1, pp 231-240) **Isotopic analysis of uranium by gamma spectrometry.** Santos, G.R. dos; Goncalves, Z.C. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The scope of this work is to study the precision degree of the determination of /sup 235/U isotopical concentration, indispensable to the control of nuclear materials under safeguards and in the stages during the enrichment process. The samples of the uranium oxid U/sub 3/O/sub 8/, obtained by uranyl nitrate 6-hidrate thermodecomposition at 1073 k, were analised by gamma spectrometry technique. The method essentially consists of measuring the 186 KeV peak, characteristic of the /sup 235/U. Several factors that affect the accuracy and precision of measurements were studied, such as thermodecomposition, sample preparation, geometry of the countings, contribution of /sup 234/Pa, self-absorption and detection efficiency. The results, submited to a statistical analyse, indicate that the technique is sensitive enough to determine the enrichment variations of 1 % and with adequate precaution it is possible to reach an accuracy of 0,4 %.

49164 (INIS-BR—1147-Vol.2, pp 443-447) **Application of the neutron activation analysis method for determing trace elements in Brazilian food sample.** Maihara, V.A.; Vasconcellos, M.B.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Recently there has been an increase of consciousness about the importance of trace elements in human health and disease as well as rising concern about food contamination. The development of sensitive, accurate and price methods is one of the most important of the knowledge of trace elements contents in foods and in biological samples. Neutron activation analysis is one of the most suitable tecniques because a great number of elements can be determined in concentrations in the range of {mu}g/g to ng/g. The present work is a part of an AIEA Co-ordinated Research Programme on the applications of nuclear techniques for toxic elements in foodstuffs. Neutron activation analysis is applied to analysis of bread, milk powder and rice that are considered essential foods in the Brazilian diet. Some aspects of the activation analysis of biological matrices are discussed.

49165 (INIS-BR—1147-Vol.2, pp 259-268) **Determination of TBP in nitric solutions of process.** Kuada, T.A.; Carvalho, E.I. de; Araujo, I.daC. de; Cohen, V.H. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Heavy organic phases have been observed on some occasions during TBP extraction process. These products, described as red oils, were considered as the main cause for process failures, specially in evaporators and concentrators. In view of safety aspects it is necessary to control organic concentration in product and waste solutions. The proposed method involves the organic removal by chloroform as a first step, followed by purification onto a silica gel column. The results are given from analysing TBP and its degradation product (DBP) by gas chromatography.

49166 (INIS-BR—1147-Vol.2, pp 395-404) **Separation of interfering elements in the neutron activation analysis of lanthanides in geological materials.** Saiki, M. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A chemical procedure has been developed for the separation of U, Th, Fe, Sc, Na, Ta, and Mo which interfere in the neutron activation analysis of the lanthanide elements in geological materials. This procedure is based on the solvent extraction of interferents using a solution of tetracycline in benzyl alcohol. The lanthanide elements remaining in the aqueous phase are coprecipitated on calcium oxalate or ferric hydroxide for irradiation and subsequent determination by gamma ray spectrometry. The chemical separation procedure was applied in the analysis of lanthanides in two international geological reference materials GSP-1 (USGS), GS-N (CRPG) and in the analysis of a volcanic rock from Pocos de Caldas, MG, Brazil. The sensitivities for all the lanthanides were determined.

49167 (INIS-BR—1147-Vol.3, pp 387-392) **Influence of the detection geometry in determining natural potassium-40 in powdered milk.** Nadai, E.A. de; Barros Ferraz, E.S. de; Pessenda, L.C.R.; Nascimento Filho, V.F. do. (Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil); Sao Paulo Univ., Piracicaba (Brazil). Escola Superior de Agricultura Luiz de Queiroz). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Samples of milk powder were analysed by gamma ray spectrometry with a coaxial HPGe-detector to evaluate activity of potassium-40 by using the same detector geometry established for other radionuclides such as Cs-137 and -134. The counting rate for photopeak of 1460,81 keV was observed to be extremely dependent of a constant geometry. The activities of potassium-40 were compared to those indirectally achieved by atomic emission spectrometry, since contents of total potassium for reference samples A-14 and A-7 from IAEA were obtained by this method with adequate precision and accuracy. Correlation coefficient of counting rate with calculated activities from chemical analysis was 0,9998**. No correlations were found for detection efficiency and sample densities. From potassium-40 activity obtained by the proposed geometry, it is possible to have good results of total potassium content of powdered milk.

49168 (INIS-BR—1147-Vol.3, pp 457-463) **Determination of Sr-90 in rain water samples.** Lima, M.F.; Cunha, I.I.L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A work that aim is to establish radiochemical method for the determination of Sr-90 in rain water samples has been studied, as a step in an environmental monitoring program of radioactive elements. The analysis includes the preconcentration of strontium diluted in a large volume sample by precipitation of strontium as carbonate, separation of strontium from interfering elements (calcium, barium and rare earths), separation of strontium from ytrium, precipitation of purified strontium and ytrium respectively as carbonate and oxalate, and counting of Sr-90 and Y-90 activities in a low background anticoincidence beta counter.

49169 (INIS-BR—1147-Vol.3, pp 465-468) **Determination of Cs-134 and Cs-137 rain water samples.** Lima, M.F.; Mazzilli, B. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

In order to setting an environmental monitoring program at IPEN, was developed a fast and simple methodology for concentration of Cs-134 and Cs-137 in rain water. This procedure consists in the precipitation of cesium and other cations of its family (NH/sub 4//sup +/, K/sup +/ and Rb/sup +/) by ammonium molybdophosphate. The measures of the desintegration rates of Cs-134 and Cs-137 was done by gamma spectrometry in a Ge(Li) detector. After setting up the ideal experimental conditions, the procedure was used to analyze four samples of rain water.

49170 **(INIS-BR—1191) Kinetic secondary deuterium isotope effect in addition of nucleophile to m-bromobenzaldehyde.** Amaral, L. do; Rossi, M.H. (Santa Catarina Univ., Florianopolis (Brazil). Dept. de Quimica). 1985. 14p. (In Portuguese). (CONF-8504335—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703884/JAW.

From 4. conference on organic physical chemistry; Florianopolis, Brazil (10 Apr 1985).

The kinetic secondary deuterium isotope effects, KD/KH for hydrated proton catalyzed addition of semicarbazide, methoxyamine and hydroxylamine to m-bromobenzaldehyde is studied. The nature of the nucleophile, addition of the carbonyl group and the chemical reactions are evaluated. (M.J.C.).

49171 **(K/QT—160-P) Sorptive removal of technetium from alkaline heavy metals sludge filtrate containing nitrate ion.** Bostick, W.D.; Evans-Brown, B.S. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1988. Contract AC05-84OT21400. 3p. (CONF-880903—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010156/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

A so-called "raffinate" waste stream is generated from various uranium recovery and equipment cleaning and decontamination activities at the X-705 facility of the Portsmouth (Ohio) Gaseous Diffusion Plant (PORTS). The composition of this waste stream is generally characterized by high concentrations of nitric acid, toxic heavy metals, and low level of radioactive nuclides (^{238}U, ^{99}Tc). We have found that cross-linked poly-4-vinyl-pyridine (PVP) resin (such as Reillex 402) is more efficient than strongly basic anion exchange resin for removed of Tc in wastes containing high concentrations of nitrate ion, resin loading by nitrate is greatly reduced, and PVP resins are very stable with respect to chemical and radiological degradation. Also the inexpensive inorganic reagents, elemental iron (degreased iron filings, about 40 mesh) and ferrous sulfide [in particular Greigite (Fe_3S_4)] are very efficient for the removal of Tc and also soluble mercury from aqueous nitrate wastes. 2 refs., 1 fig., 4 tabs.

49172 **(KFK—3613) Fluorination of solid UF/sub 6/ decomposition products by gaseous mixtures of CBrF/sub 3/ and F/sub 2/.** Bacher, W.; Becker, E.W.; Bier, W.; Maner, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernverfahrenstechnik; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Oct 1983. 54p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754667/JAW.

Gaseous mixtures of CBrF/sub 3/ and F/sub 2/ exhibits some advantages in the removal of solid UF/sub 6/ decomposition products from uranium enrichment installations. To facilitate optimal application, the self decomposition of these mixtures as well as their interactions with uranyl fluoride have been studied in a stainless steel cell equipped with AgCl windows for IR analysis. It has been found tha self decomposition with low F/sub 2/ content causes BrF/sub 3/ to show up besides the common reaction products, BrF/sub 5/ and CF/sub 4/. The fluorination of uranyl fluoride results in a retardation of the BrF/sub 5/ formation as compared to the formation of CF/sub 4/ due to a temporary accumulation of bromine in low valency states on the surface of the solid uranium compound. The reaction rate for the fluorination of uranyl fluoride increases within certain limits with decreasing F/sub 2/ content of the mixture. For the practical application of the more reactive mixtures with low F/sub 2/ content it is important that, after total consumption of F/sub 2/ the residual CBrF/sub 3/ may attack the UF/sub 6/ formed by fluorination of the solid uranium compound. Therefore, F/sub 2/ has to be added or the mixture has to be pumped off in time. To verify the practical usefulness of the gas mixtures, technical separation nozzle elements have been polluted artificially with UF/sub 6/ reduction and hydrolysis products and afterwards exposed to the gaseous CBrF/sub 3//F/sub 2/ mixture in further experiments. The efficiency of the separation nozzle elements has been determined in separation experiments before and after the pollution as well as after the fluorination treatment. Furthermore, the condition of the separation elements has been recorded by scanning electron micrographs. (Abstract Truncated)

49173 **(LBL—24971) Two-dimensional spatially resolved Raman spectroscopy of solid materials.** Veirs, D.K.; Rosenblatt, G.M.; Dauskardt, R.H.; Ritchie, R.O. (Lawrence Berkeley Lab., CA (USA)). Mar 1988. Contract AC03-76SF00098. 9p. (CONF-880841—18). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014867/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

Chemical compositional analysis of solid materials often is based upon vibrational spectroscopy, either infrared or Raman. Vibrational analysis is particularly valuable. The development of mutichannel detection systems for Raman spectroscopy coupled with microscopic techniques has resulted in a number of commercial Raman microprobes (from Spex Industries, Jobin-Yvon ISA, Dilor,

for example) capable of probing areas on the order of 100 μm^2 routinely. For macroscopic samples, with dimensions of thousands of microns on a side, an instrument which mutiplexes both the spatial domain and wavelength would enhance the capability of Raman spectroscopy. We report on the development of such a Raman instrument and describe, as an example, its application to the investigation of the phase transformation accompanying crack growth in partially stabilized zirconia (PSZ). 5 figs., 4 refs.

49174 **(LBL—25203) Background modelling alternatives in electron energy-loss spectroscopy and their implications on microanalysis.** Krishnan, K.M.; Stampfer, M.T. (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract AC03-76SF00098. 4p. (CONF-880841—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010361/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

With the advent of parallel detectors, electron energy-loss spectroscopy (EELS) is expected to be employed increasingly in the routine microanalysis of light elements. The quantitation formulae that are used are relatively simple and straightforward and require only a measurement of the integrated core-loss intensity over a particular energy window beyond the ionization edge ({triangle{sub i}}) and most often, a calculated ionization cross-section. Even though the hydrogenic cross-sections that are used routinely for microanalysis can be a source of error, it is observed that the procedure that largely determines the accuracy of quantification is the removal of the contribution of the background below the ionization edge. 5 refs., 1 tab.

49175 **(OEFZS—4438) Neutron activation analysis of antimony in chromatin and nucleoids of HeLa cells.** Ashry, H.A.; Topaloglou, A.; Altmann, H. (National Centre for Radiation Research and Technology, Cairo (Egypt); Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Biologie). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Feb 1988. 6p. (In German). (BL—695/88). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704054/JAW.

Antimony seems to be cancerogenic in men. In the present investigations we tried to find out if Sb/sup +++/ are also bound to the cell nucleus. HeLa cells were incubated with SbCl/sub 3/ and after a 18 h incubation time cells were lysed and crude chromatin isolated. In this preparation Sb was determined by neutron activation analysis. From the same cell culture nucleoids were prepared by ultracentrifugation and also Sb detected in these structures. 12 refs., 2 tabs.

49176 **(ORNL/TM—10542) Technology assessment of field portable instrumentation for use at Rocky Mountain Arsenal: Final report.** Jenkins, R.A.; Maskarinec, M.P.; Griest, W.H.; Dyer, F.F.; Moody, R.L.; Buchanan, M.V. (Oak Ridge National Lab., TN (USA)). Mar 1988. Contract AC05-84OR21400. 107p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88015357/JAW.

An assessment was made of commercially available field instrumentation for analysis of samples at Rocky Mountain Arsenal. The analytes considered were metals, volatile organics, and semivolatile organics. Colorimetrics tests for metals are recommended for screening, with positives being confirmed by microwave digestion followed by portable atomic absorption. A portable mercury monitor is recommended for this analysis. Portable x-ray fluorescence is recommended for higher levels of inorganics. For volatile organics, purge and trap and heated headspace followed by portable gas chromatography are recommended. For semivolatiles in soil, SOXTEC extraction and gas or thin layer chromatography are recommended. For semivolatiles is water, solvent extraction using a MIXXOR is recommended. 1 fig., 13 tabs.

49177 **(PNL—15577) Neutron activation and mass spectrometric measurement of {sup 129}I.** Strebin, R.S. Jr.; Brauer, F.P.; Kaye, J.H.; Rapids, M.S.; Stoffels, J.J. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1987. Contract AC06-76RL01830. 19p. (CONF-8806199—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014756/JAW.

From 36. annual conference on mass spectrometry and allied topics; San Francisco, CA, USA (6 Jun 1988).

An integrated procedure has been developed for measurement of {sup 129}I by neutron activation analysis and mass spectrometry. An iodine isolation procedure previously used for neutron activation has been modified to provide separated iodine suitable for mass spectrometric measurement as well. Agreement between both methods has been achieved within error limits. The measurement limit by each method is about 10{sup 7} atoms (2 fg) of {sup 129}I. 13 refs,. 4 figs., 1 tab.

49178 **(PNL-SA—15664) Electrospray ionization phenomena and the interface of capillary electrophoresis and mass spectrometry.** Smith, R.D.; Barinaga, C.J.; Udseth, H.R. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 4p. (CONF-8806199—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88014080/JAW.

From 36. annual conference on mass spectrometry and allied topics; San Francisco, CA, USA (6 Jun 1988).

Recently a new electrospray ionization interface for capillary electrophoresis-mass spectroscopy (CE-MS) has been developed. The interface uses a sheath flow of liquid to make electrical contact at the CZE terminus, thus defining both the CZE and electrospray field gradients. Ions created by the ESI process are sampled through a 1 mm nozzle into a region mechanically pumped at 50 L/s using a single-stage roots blower. The ions entering this region are sampled through a 2 mm dia skimmer orifice located 0.5 cm behind the nozzle orifice. Ions passing through the skimmer enter a radio frequency focusing quadrupole. This region is pumped by a cryopump. A mixture of four quaternary phosphonium salts is used to illustrate capillary electrophoresis separations with mass spectroscopy and their uses. 2 figs.

49179 **(PNL-SA—15730) An improved interface for capillary zone electrophoresis-mass spectrometry.** Smith, R.D.; Loo, J.A.; Barinaga, C.J.; Udseth, H.R. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 4p. (CONF-8806199—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014079/JAW.

From 36. annual conference on mass spectrometry and allied topics; San Francisco, CA, USA (6 Jun 1988).

We have recently developed an improved electrospray ionization interface for capillary electrophoresis mass-spectrometry (CZE-MS). Our initial interface employed a vacuum deposited metal film at the exit of the capillary to make an electrical contact with he eluting buffer and establish the electrospray field gradient. This interface did, however, impose significant limitations on the range of capillary electrophoretic (CE) separations that could be performed. To circumvent these limitations, an interface that does not require a metalized tip was designed nd developed. In the new approach, the electrical contact at the column exit is made through a flowing liquid sheath. The principal advantage of this interface is that it allows operation with a much broader range of electrophoresis conditions. The sheath flow can be readily varied in both composition and volume. An electrospray ionization spectrum is given for a previously intractable buffer solution. 5 refs., 2 figs.

49180 **(UCRL—98002) Experimental and modeling study of the oxidation of n-butane at low and intermediate temperatures.** Pitz, W.J.; Wilk, R.D.; Westbrook, C.K.; Cernansky, N.P. (Lawrence Livermore National Lab., CA (USA)). 11 Jan 1988. Contract W-7405-ENG-48. 26p. (CONF-880802—4). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88005476/JAW.

From 22. international symposium on combustion; Seattle, WA, USA (14 Aug 1988).

An experimental and modeling study of n-butane oxidation in a static reactor was conducted at temperature encompassing the negative temperature coefficient region and portions of the low and intermediate temperature regimes. The numerical model employed a detailed chemical kinetic mechanism for n-butane oxidation. Conditions considered in the combined study were temperatures in the range of 554-737 K, an initial pressure of 550 torr, and a molar mixture ratio of 1:20:20.33 n-butane:O_2:N_2. The induction period and stable species concentrations were measured and compared to mod-

eling predictions. The variation in induction period over the region of negative temperature coefficient is well-predicted by the model. The model is also used to analyze the static reactor data of Baker et al. who investigated n-butane/H_2/O_2N_2 mixtures. The agreement between their detailed species concentration measurements and the modeling predictions is good. Modeling calculations identified some of the key reactions at the conditions investigated. Internal H-atom abstractions of the butyl peroxy radicals and subsequent reactions contributed significantly to the major intermediate species that were observed and to the production of reactive OH radicals. Additionally, radical-radical reactions involving the HO_2 radical consumed a significant amount of butyl peroxy radicals and accelerated the overall rate of oxidation. 53 refs., 5 figs., 1 tab.

49181 Hydrogen sensing with palladium-coated optical fibers. Butler, M.A.; Ginley, D.S. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **64**: No. 7, 3706-3712(1 Oct 1988).

Palladium-coated, single-mode optical fibers have been used to detect hydrogen in a concentration range 20 parts per billion to 2% in 1 atm of nitrogen. When the coated fibers are exposed to hydrogen, a hydride is formed with an expanded lattice constant, which stretches the optical fiber. This change in optical path length is measured using a Mach—Zehnder interferometer. A simple one-dimensional model is presented and shown to accurately reproduce the fiber response. Using electrodeposited palladium films, a factor of 7 enhancement in the hydrogen solubility is observed, as well as a deeply bound site which is saturated in the parts per million concentration range. The data suggest that this site may be due to hydrogen binding to a free surface of the palladium.

49182 Two-wavelength single laser CH and CH_4 imaging in a lifted turbulent diffusion flame. Namazian, M.; Schmitt, R.L.; Long, M. (Altex Technologies Corporation, 109 Via De Tesoros, Los Gatos, California 95030). *Applied Optics;* **27**: No. 17, 3597-3600(1 Sep 1988).

A new technique has been developed which allows simultaneous 2-D mapping of CH and CH_4 in a turbulent methane flame. A flashlamp-pumped dye laser using two back mirrors produces output at 431.5 and 444 nm simultaneously. The 431.5-nm line is used to excite the (0,0) band of the A^2@gD—X^2@mX system of CH, and the fluorescence of the (0,1) transition is observed at 489 nm. Coincidentally, the spontaneous Raman scattering from CH_4 also occurs near 489 nm for a 431.5-nm excitation. To separate the CH_4 and CH contributions, the 444-nm line is used to produce a spontaneous Raman signal from CH_4 that is spectrally separated from the CH fluorescence. Subtraction of the signals generated by the 431.5- and 444-nm wavelength beams yields separate measurements of CH_4 and CH. Raman-scattered light records the instantaneous distribution of the fuel, and simultaneously the CH fluorescence indicates the location of the flame zone. The resulting composite images provide important insight on the interrelationship between fuel—air mixing and subsequent combustion.

49183 Picosecond flash photolysis apparatus with high absorbance resolution. Ebbesen, T.W. (Radiation Laboratory, University of Notre Dame, Notre Dame, Indiana 46556). *Review of Scientific Instruments;* **59**: No. 8, 1307-1309(Aug 1988).

A new picosecond flash photolysis apparatus is described which makes extensive use of fiber optics in the probing beam pathway. The apparatus is simple and easy to use. The absorbance resolution and accuracy are greatly enhanced and allow for quantitative determination of properties of transient species. The capability of the system is illustrated by determining the excited singlet state absorbance properties of erythrosine and rose bengal.

49184 (PNL-tr—469) Voltammetric determination of technetium at ultra-small concentrations by concentation at the HMDE after reaction with thiocyanate. Friedrich, M.; Ruf, H. (Pacific Northwest Lab., Richland, WA (USA)). 1988. Contract AC06-76RL01830. Translation of Voltammetrische Bestimmung von Technetium extrem kleiner konsentrationen bei anreicherung an der HMDE nach reaktion mit rhodanide. 13p. NTIS, PC A03. Order Number DE88013899/JAW.

It is known that in sulfuric acid solution pertechnetate is reduced by thiocyanate to form thiocyanate complexes. After this reaction, the technetium can be adsorbed at the hanging mercury drop electrode (HMDE) provided that a potential of {minus}0.40 V (vs. Ag/AgCl) has been applied to the electrode. If differential pulse voltammetry with cathodic potential scan is conducted after the deposition cycle, traces of technetium can be determined very sensitively using the current peak recorded at {minus}1.27 V (Ag/AgCl). The effect is enhanced even more by the presence of small amounts of perrhenate which do not interfere. The reproducibility of the measured values is excellent. 9 refs., 11 figs.

4002 Inorganic, Organic And Physical Chemistry

REFER ALSO TO CITATION(S) 48031, 48035, 48040, 48055, 48056, 48079, 48112, 48354, 48391, 49002, 49074, 49214, 49489, 49609, 49633, 49719, 49840

49185 (AD-A—193950/3/XAB) Vibrational overlap integrals between the neutral and ion states of NH_3 and ND_3: application to the vibrational dependence of the NH_3+(v2) + NH_3(0) symmetric charge transfer reaction. Interim report. Ebata, T.; Conaway, W.E.; Zare, R.N. (Stanford Univ., CA (USA). Dept. of Chemistry). 1987. 15p. NTIS, PC A03/MF A01.

Pub. in International Jnl. of Mass Spectrometry and Ion Processes, Vol. 80, 51-62(1987).

Vibrational overlap integrals were calculated for the transition between the neutral ground state and the ion state of ammonia and ND_3 for the vibrational bending mode. Calculations were performed by numerically solving the Schroedinger equation. The vibrational overlap integrals were used to simulate the dependence of the cross section for the symmetric charge-transfer reaction on the initial vibrational quantum state of the ion. The cross sections show a gradual increase with the vibrational bending mode in agreement with experiment.

49186 (CEA-R—5443) Study of the chemical behaviour of technetium during irradiated fuels reprocessing. Zelverte, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). Apr 1988. 142p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88754723/JAW.

This paper deals with the preparation of the lower oxidation states +III +IV and +V of technetium in nitric acid and its behaviour during the reprocessing of nuclear fuels (PUREX process). The first part of this work is a bibliographical study of this element in solution without any strong ligand. By chemical and electrochemical technics, pentavalent, tetravalent and trivalent technetium species, were prepared in nitric acid. The following chemical reactions are studied: - trivalent and tetravalent technetium oxidation by nitrate ion. - hydrazine and tetravalent uranium oxidation catalysed by technetium: in those reactions, we point out unequivocally the prominent part of trivalent and tetravalent technetium, - technetium behaviour towards hydroxylamine. Technetium should not cause any disturbance in the steps where hydroxylamine is employed to destroy nitrous acid and hydrazine replacement by hydroxylamine in uranium-plutonium partition could contribute to a best reprocessing of nuclear fuels.

49187 (CONF-880802—7) Theoretical study of the reaction rates of OH + OH {Longleftrightarrow} H_2O + O. Harding, L.B.; Wagner, A.F. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88010077/JAW.

From 22. international symposium on combustion; Seattle, WA, USA (14 Aug 1988).

The rate constants for the forward and reverse reaction of OH + OH to form H_2O + O are calculated with variational transition state theory using an ab initio MCSCF electronic structure characterization of the reaction path on the two potential energy surfaces that correlate reactants with products. With the scaling of the potential barrier so as to match experiment at room temperature, excellent agreement with experiment for the forward direction is obtained over the full temperature range, including a sharp

upward curvature above 1000{degree}K. The excited state surface is shown to be important in this curvature, contributing over 35% of the rate constant at higher temperatures. For the reverse direction, it is argued that the $H_2O + O$ measured rates are about a factor of two too large. 25 refs., 4 figs.

49188 **(DOE/ER/01198—T18) Polysilicic acid esters as precursors to new ceramic materials.** Millar, D.M. (Illinois Univ., Urbana (USA)). 1987. Contract AC02-76ER01198. 169p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88014627/JAW.

Two simple siloxane ester chains, [Si{sub 2}O](OCH{sub 3}){sub 6} and [Si{sub 3}O{sub 2}](OCH{sub 3}){sub 8}, and a polysilicic acid ester [Si{sub 8}O{sub 12}](OCH{sub 3}){sub 8} were prepared. {sup 29}Si NMR and single-crystal x-ray analysis were used. Hydrolysis-condensation [Si{sub 2}O](OCH{sub 3}){sub 6} and [Si{sub 3}O{sub 2}](OCH{sub 3}){sub 8} produced monomer degradation at low rates. Similar experiments on [Si{sub 8}O{sub 12}](OCH{sub 3}){sub 3} indicated that these reactions proceeded without cage degradation. {sup 29}Si FTMAS and CPMAS NMR showed that gels prepared from Si (OCH{sub 3}){sub 4}, [Si{sub 2}O](OCH{sub 3}){sub 6}, and [Si{sub 3}O{sub 2}](OCH{sub 3}){sub 8} exhibited similar distributions of Q{sup 2}, Q{sup 3}, and Q{sup 4} sites. Observation of Q{sup 2} silicon centers demonstrated that degradiation of the [Si{sub 8}O{sub 12}] cage had occurred. Further distinctions between the gels were made, based on spin-lattice relaxation for the Q{sub 4} silicons. A series of [Si{sub 8}O{sub 12}]-based molecules bearing a single reactive site were synthesized in order to study the condensation behavior of the Q{sup 3}-[Si{sub 8}O{sub 12}] centers. [Si{sub 8}O{sub 12}][OSi(CH{sub 3}){sub 3}]{sub 7}H was prepared from [Si{sub 8}O{sub 12}]H{sub 8}. Reaction of this monosilane with (CH{sub 3}){sub 3}SnOCH{sub 3} produced {Si{sub 8}O{sub 12}][OSi (CH{sub 3}){sub 3}]{sub 7}OSn(CH{sub 3}){sub 3}. Hydrolysis of the stannoxy adduct with HCl yielded the stable, crystalline monosilicic acid [Si{sub 8}O{sub 12}]OSi (CH{sub 3}){sub 3}]{sub 7}OH. Silicic acid self-condensation was found to be catalyzed by bases but not by acids. No evidence of cage degraded products were observed. The monosilicic acid was found to readily react with [Si{sub 8}O{sub 12}](OCH{sub 3}){sub 8} to yield the mixed dimer [(CH{sub 3}){sub 3}SiO][sub 7}[Si{sub 8}O{sub 12}]O[Si{sub 8}O{sub 12}](OCH{sub 3}){sub 7}. 25 figs., 5 tabs.

49189 **(DOE/ER/13531—2) In-situ UV diffuse reflectance studies in heterogeneous catalysis: Progress report, December 1, 1987--November 30, 1988.** Gonzalez, R.D. (Chicago Univ., IL (USA)). Aug 1988. Contract FG02-86ER13531. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015711/JAW.

The effect of catalyst pretreatment on the surface composition of supported bimetallic clusters is currently under study using the following techniques: (1) in-situ diffuse uv spectroscopy, (2) differential scanning calorimetry and (3) electron microscopy. In- situ uv diffuse reflectance spectroscopy is being used to study the nature of the surface diffusion of the precursor over the silica support. Quantitative differential scanning calorimetry is currently being used to compare heats of reduction of the pure metal precursors to those obtained for the supported catalysts. It is proposed that this study will enable us to arrive at the correct reduction sequence. Scanning transmission electron microscopy (STEM) is currently under use to determine the composition distribution of the supported bimetallic particles over the catalyst surface. EDXS, electron diffuse x-ray spectroscopy is being used to determine the elemental analysis of individual catalyst particles. Catalytic reactions are being used as surface probes to establish the nature and distribution of the dual metal sites obtained on the supported bimetallic particles. Ensemble sizes and their roles in heterogeneous catalyzed reactions are being investigated. 5 refs.

49190 **(DOE/ER/13653—2) [Utilization of magnetic effects as a means of isotopic enrichment]: Technical progress report, January 1, 1988 to August 31, 1988.** (Columbia Univ., New York (USA)). 1988. Contract FG02-87ER13653. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014789/JAW.

Photolysis of ketones in micelles or porous surfaces is being used for separation of magnetic isotopes (^{13}C, ^{17}O). Large-ring cyclic ketones of ring size 7 to 15 have been synthesized, and the maximum enrichment falls in the middle of the ring sizes investigated. Effects of reaction conditions were investigated. Exploration of environmental variations that will enhance the ^{13}C separation continued (surfactant aggregation, etc.). Zeolites will be investigated. (DLC)

49191 **(DOE/ER/13758—1) Thermodynamic properties by non-calorimetric methods: Progress report.** Strube, M.M.; Chirico, R.D.; Collier, W.B.; Steele, W.V. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). 1988. Contract FG05-87ER13758. 10p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88015422/JAW.

This project for the Office of Energy Research focuses on the noncalorimetric determination of thermodynamic properties of polynuclear aromatic molecules through the extension of existing correlation methodologies and through molecular spectroscopy with statistical mechanics. This report highlights progress during the first third of the contract period. Important advances include: derivation of group-contribution parameters for estimation of thermodynamic properties for polycyclic hydrocarbon and nitrogen-containing compounds; calculation of thermodynamic properties for eight key monocyclic compounds based on new and literature spectra were completed for the derivation of {open+-quotes}ring-correction{close+-quotes} property estimation parameters; design and construction of a long pathlength, far-infrared sample cell for the collection of vapor-phase spectra of low vapor-pressure compounds; development of a method to predict the vibrational frequencies of two- and three-ring polycyclic molecules to an accuracy sufficient for identifying the fundamental vibrations in experimental spectra; development of a method to calculate the kinetic energy expansions as a function of the coordinate for the ring-puckering, ring-twisting (in-phase), and ring-twisting (out-of-phase) vibrations of 9,10-dihydroanthracene and related molecules; and derivation of the standard enthalpy of formation of [1.1.1]propellane from measurement of the standard enthalpy of formation of 3-methylenecyclobutylacetate to compare with ab initio calculation results. 14 refs.

49192 **(DOE/PC/79929—1) NO{sub x}-char reactions: Kinetics and transport aspects: Quarterly technical progress report, 1 January 1988-31 March 1988.** Calo, J.M.; Suuberg, E.M.; Makhija, S.; Teng, H.; Lilly, W.D. (Brown Univ., Providence, RI (USA). Div. of Engineering). 1988. Contract FG22-87PC79929. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013722/JAW.

Reduction of NO{sub x} emissions from coal combustors remains among the most important unresolved environmental control problems associated with the utilization of coal. In stationary combustion devices, NO{sub x} is produced from both nitrogen in the combustion air and from the fixed fuel nitrogen (i.e., originating from the chemical matrix of the fuel). Combustion of coal generally results in the conversion of about 15{endash}40{percent} of the fuel nitrogen to NO. It is generally agreed that most of the primary NO{sub x} formed in combustors is as NO rather than NO{sub 2}. The formation mechanisms of NO{sub x} have received significant attention. NO{sub x} formation from fuel nitrogen, for example, has been found to be dependent on a complex series of homogeneous and heterogeneous mechanistic steps. However, an understanding of NO formation is only part of the story; the development of NO control strategies must also be guided by a knowledge of its destruction mechanisms. An appreciable portion of the NO initially formed within the particle (i.e., from fuel nitrogen) can be destroyed by NO-char reactions before it can ever escape. The destruction of NO external to the particle includes both homogeneous gas phase processes and heterogeneous processes that require transport of NO to the surface, including gas-solid reactions between the char and NO, and/or catalytic reactions between absorbed species, such as NO and CO, on the char surface. Different mechanisms are believed to predominate in different situations. This difficulty in drawing firm conclusions regarding the role of heterogeneous NO{sub x} reduction mechanisms is partly due to the fact that some aspects remain very poorly understood. The objective of this project is to develop an improved understanding of the chemical

kinetics and mass transport characteristics of the heterogeneous interactions of NO{sub x} with char. 39 refs., 6 figs., 2 tabs.

49193 **(EGG—10282-2147) Study of mercuric iodide near melting using differential scanning calorimetry Raman spectroscopy, and x-ray diffraction.** Burger, A.; Morgan, S.; Jiang, H.; Silberman, E.; Schnieber, M.; van den Berg, L.; Keller, L.; Wagner, C.N.J. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). 1987. Contract AC08-83NV10282. 24p. (CONF-8709315—8). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014957/JAW.

From 6. international workshop on compound semiconductors for room temperature X-ray and nuclear detectors; Davos, Switzerland (14 Sep 1987).

High-temperature studies of mercuric iodide (HgI_2) involving differential scanning calorimetry (DSC), Raman spectroscopy, and x- ray powder diffraction have failed to confirm the existence of a red-colored tetragonal high-temperature phase called α'-HgI_2 reported by S.N. Toubektsis et al., (S.N. Toubektsis, E.K. Polychroniadis, and N.A. Economou, J. Appl. Phys., 58(5) (1985) 2070), using DSC measurements. The multiple DSC peaks near melting reported by Toubektsis are found by the present authors only if the sample is heated in a stainless-steel container. Using a Pyrex container or inserting a platinum foil between the HgI_2 and the stainless-steel container yields only one sharp, single DSC peak at the melting point. The nonexistence of the α' phase is confirmed by high- temperature x-ray diffraction and Raman spectroscopy performed in the vicinity of the melting point which clearly indicate the existence of the yellow orthorhombic β-HgI_2 phase only. The experimental high-temperature DSC, Raman, and x-ray diffraction data are presented and discussed. 14 refs., 8 figs., 2 tabs.

49194 **(EGG—10282-2156) Modified purification of mercuric iodide for crystal growth.** Skinner, N.L.; Ortale, C.; Schieber, M.M.; van den Berg, L. (EG and G, Inc., Goleta, CA (USA). Santa Barbara Operations). 1988. Contract AC08-83NV10282. 24p. (CONF-8709309—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014960/JAW.

From 2. workshop on purification of materials for crystal growth and glass processing; Champion, PA, USA (28 Sep 1987).

The standard procedure used in our laboratory to purify commercially available mercuric iodide consists of a sequence of steps: (1) repeated sublimation under continous evacuation, followed by (2) melting and recrystallization, and (3) a sublimation process in a closed tube. This paper describes a modification of the standard purification sequence by adding recrystallization of the mercuric iodide in hydrochloric acid. Leaching cation impurities out of mercuric iodide powder with hydrochloric acid has been practiced before by Zaletin, [V.M. Zaletin, I.H. Nozhiua, I.N. Fomin, V.T. Shystov, and N.V. Protasov, Atomic Energy 48, 169 (1980)]. Our objective for the hydrochloric acid treatment was to remove nitrates and hydrocarbons which were interfering with the vapor transport during crystal growth. Results of the procedure are presented in terms of total carbon and selected ion content of the treated and untreated material. 13 refs., 8 figs., 3 tabs.

49195 **(EGG-M—41987) A fluidized-bed continuous bioreactor for lactic acid production.** Andrews, G.F.; Fonta, J.P. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1988. Contract AC07-76ID01570. 28p. (CONF-880521—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015127/JAW.

From 10. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (16 May 1988).

A laboratory bioreactor consists of a fluidized bed of monosized activated carbon coated with a biofilm of the homolactic fermentative organism Streptococcus thermophilus. Biofilm growth moves the carbon through the bed, and adsorption of substrate and product at the bottom and top of the bed respectively reduces their inhibitory effects on the organism. Theory shows that high reactor productivity and rapid recirculation of carbon through the bed require a biofilm thickness of 25 to 45% of the carbon particle radius on particles fed into the base of the bed. This could not be achieved in practice due to the fragility of the biofilm. Product concentration was higher than expected from measurements of product inhibition, possibly because it is the undissociated form of the acid that both inhibits metabolism and adsorbs on the activated carbon. The observed productivity of 12 gm/1 hr could be greatly increased by ph control. 13 refs., 7 figs., 2 tabs.

49196 (INIS-BR—1147-Vol.2, pp 217-223) **Preparation of plastic scintillation detectors and characterization of physico-chemical parameters.** Hamada, M.M.; Mesquita, C.H. de. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The development of plastic scintillators for using in the nuclear radiation detection is described. The detectors were fabricated by the polymerization of styrene with organic fluors. The organic fluors used were PPO (1,4 difenil-oxazol) and POPOP 1,4-di-2-(5-fenil-oxazolil) benzene in proportions of 0,5 and 0,05% respectively. Physical-chemistry parameters related to the quality of this detector are investigated at this laboratory. The evaluation of its fluorescency characteristics, density, melting softening, refractive index, molecular weight, gama and alfa espectrometry characteristics and finally the comparative pulse height analysis indicate that the plastic scintillator produced at this laboratory is comparable with others already described.

49197 (INIS-BR—1147-Vol.2, pp 433-436) **Reduction of low concentration Cr(VI) in nitric acid solutions.** Archundia, C.; Collins, C.H.; Collins, K.E. (Universidad Nacional Autonoma de Mexico, Mexico City; Universidade Estadual de Campinas (Brazil)). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

/sup 51/Cr(VI) is reduced at room temperature by nitric acid, producing several /sup 51/Cr(III) species, as determined by ion exchange chromatographic analysis. The reduction is observed at all nitric acid concentrations tested, from 10/sup -3/ mol L/sup -1/ to fuming nitric acid (90%); the rate of reduction depends on the acid concentration.

49198 **(INIS-BR—1214) Determination of calcium, copper, chromium, iron, magnesium, manganese, potassium, sodium and zinc in ethanol by atomic absorption spectrometry.** Fernandes, E.A.N. (Sao Paulo Univ., Piracicaba (Brazil). Escola Superior de Agricultura Luiz de Queiroz). 1981. 86p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704006/JAW.

The direct determinacao of calcium, copper, chomium, iron, magnesium, manganese, potassium, sodium and zinc in ethanol by atomic absorption spectrometry with, air-acetylene flame is proposed. Effects of fuel/oxidant ratio, burner height and water content in the samples were investigated in detail. The method allows the determition of the elements with good precision (r.s.d. $< 4.5\%$ for low concentrations) and good accuracy (mean recoveries of 100% after standard additions). The limits of detection ranged from 0.0004 to 0.0088μg.ml/sup -1/ for the elements tested.

49199 **(LA-UR—88-186) Direct measurements of methoxy removal rate constants for collisions with CH_4, Ar, N_2, Xe, and CF_4 in the temperature range 673–973K.** Wantuck, P.J.; Oldenborg, R.C.; Baugchum, S.L.; Winn, K.R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-880802—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005391/JAW.

From 22. international symposium on combustion; Seattle, WA, USA (14 Aug 1988).

Removal rate constants for CH_3O by CH_4, Ar, N_2, Xe, and CF_4 were measured over a 400K temperature range using a laser photolysis/laser-induced fluorescence technique. Rapid methoxy removal rates are observed for the non-reactive collision partners (Ar, N_2, Xe, and CF_4) at elevated temperatures showing that the dissociation and isomerization channels for CH_3O are indeed important. The total removal rate constant (reaction {plus} dissociation

and/or isomerization) for CH_4 exhibits a linear dependence on temperature and has a removal rate constant, k/sub r/ {equals} (1.2 +- 0.6) {times} 10/sup {minus}8/exp[({minus}101070 +- 350)/T]cm³molecule/sup {minus}1/s/sup {minus}1/. Assuming that the removal rate constant due to dissociation and/or isomerization are similar for CH_4 and CF_4, the reaction rate constant for CH_3O {plus} CH_4 is equal to (1.7 +- 1.0) {times} 10/sup {minus}10/exp[({minus}7480 +- 1100)/T]cm³molecule/sup {minus}1/s/sup {minus}1/. 7 refs., 4 figs.

49200 **(LA-UR—88-1791) Ab initio studies of transition-metal dihydrogen chemistry.** Kober, E.M.; Hay, P.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 19p. (CONF-8806182—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014467/JAW.

From Symposium on computational chemistry: the challenge of d and f electrons; Toronto, Canada (6 Jun 1988).

Examples of transition metal complexes containing dihydrogen ligands are investigated using ab initio electronic structure calculations employing effective core potentials. Calculated geometrical structures and relative energies of various forms of $WL_6(H_2)$ complexes (L = CO, PR_3) are reported, and the influence of the ligand on the relative stabilities of the dihydrogen and dihydride forms is studied. The possible intramolecular mechanisms for H/D scrambling are investigated in another d^6 complex, $Cr(CO)_4(H_2)_2$, where various polyhydride intermediates are possible. 8 refs., 6 figs., 1 tab.

49201 **(LA-UR—88-2524) Hugoniot measurements in bromoform: Looking for shock-induced reaction.** Sheffield, S.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-8809109—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014407/JAW.

From Shock wave symposium; Pullman, WA, USA (1 Sep 1988).

Electromagnetic particle velocity gauging has been used to measure shocks in bromoform to determine at what pressure shock-induced reaction occurs. Earlier work done at Los Alamos seemed to indicate reactions may occur at pressures as low as 3 GPa. Five experiments were done between 3 and 10 GPa. No evidence of reaction was observed in any of these experiments, although the data at 10 GPa had some unexplained perturbations in them. The data were very close to the universal liquid Hugoniot prediction for bromoform. Based on this and the earlier higher pressure data, it is estimated that reaction begins at shock pressures above 10 GPa, eliminating this material as a candidate for further easy study on our single-stage gun. 7 refs., 1 fig.

49202 **(MLM—3527) Mound activities in chemical and physical research, July-December 1987.** Kramer, L.R. (ed.). (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 29 Jul 1988. Contract AC04-76DP00053. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015149/JAW.

The following three research areas are presented: Work focusing on the enrichment of calcium isotopes by chemical exchange continued, with emphasis on calcium exchange with resin-bound cryptands. Bromine isotopic thermal diffusion factors were measured for methyl bromide, ethyl bromide, and 1-bromopropane; and a method for determining equilibrium fractions of plutonium oxidation states, as well as the final acidity associated with the distribution, is illustrated and discussed. Individual projects are processed separately for the data bases.

49203 **(PB—88-218508/XAB) Determination of droplet size and ground contamination using detection papers.** Sandberg, M.; Zetterstroem, B.; Faengmark, I. (Foersvarets Forskningsanstalt, Umeaa (Sweden)). Mar 1988. 29p. (In Swedish). (FOA-C—40250-4.6). NTIS, PC E03/MF A01.

A method was developed for the determination of droplet size and ground contamination using detection papers. The relation between droplet size and distribution on detection papers was studied at different impact velocities and temperatures. The work resulted in a droplet template that can be used in order to determine the droplet size directly in the field. The method was tested in large-scale field trials using a training agent. The method was easy to use and relatively fast, but less accurate than traditional chemical analytical methods.

49204 **Quantum mechanical treatment of vibrational mixing in ethylene dimer and rare gas—ethylene complexes.** Hair, S.R.; Beswick, J.A.; Janda, K.C. (Department of Chemistry, University of Pittsburgh, Pittsburgh, Pennsylvania 15260). *Journal of Chemical Physics;* **89**: No. 7, 3970-3982(1 Oct 1988).

An approximate description of the van der Waals vibrations of ethylene dimer and rare gas—ethylene complexes is presented. Using a model atom—atom potential, this calculation examines the mixing of the ethylene ν_7 vibration with a set of background vibrational levels, consisting of combinations of the van der Waals vibrations and the ethylene ν_{10} vibration. The ethylene dimer exhibits extensive vibrational mixing, while the rare gas—ethylene molecules do not. For the ethylene dimer, calculated line strengths produce a complex spectrum of vibrational lines that span a 10 cm^{-1} region, in agreement with the experimental spectrum. This result suggests new explanations for the coexistence of broad and narrow lines in the ethylene dimer ν_7 dissociation spectrum.

49205 **Vibrationally resolved electronic autoionization of core—hole resonances.** Poliakoff, E.D.; Kelly, L.A.; Duffy, L.M.; Space, B.; Roy, P.; Southworth, S.H.; White, M.G. (Department of Chemistry, Boston University, Boston, Massachusetts 02215). *Journal of Chemical Physics;* **89**: No. 7, 4048-4053(1 Oct 1988).

We investigate the dynamics of molecular core—hole decay using dispersed fluorescence from an ionic valence—hole state in N_2. A core—hole excited state is created via the $N_2(1s\rightarrow 1\ \pi$/sup *//sub g/) transition, and this state electronically autoionizes to the $N^+{}_2(B\ ^2\Sigma^+$/sub u/) state. The vibrational branching ratios for the $N^+{}_2(B\ ^2\Sigma^+$/sub u/) state are then determined from $N^+{}_2(B\ ^2\Sigma^+$/sub u/$\rightarrow X\ ^2\Sigma^+$/sub g/) fluorescence. Fundamental aspects of core—hole state decay emerge clearly from these measurements. In particular, interference effects due to lifetime broadening of vibrational levels of the core—hole state can be investigated quantitatively using this method. As a result, dispersed fluorescence detection serves as a powerful tool for investigating R-dependent aspects of molecular core—hole resonances. The experimental results do not agree with predictions based on previous theoretical developments, and possible causes for the discrepancy are discussed.

49206 **Shape resonance influence on the photoelectron angular distributions from O_2 C ^{3}Pi/sub g/, v = 0—3.** Miller, P.J.; Chupka, W.A.; Winniczek, J.; White, M.G. (Sterling Chemistry Laboratory, Yale University, New Haven, Connecticut 06511-8118). *Journal of Chemical Physics;* **89**: No. 7, 4058-4061(1 Oct 1988).

Vibrationally resolved, photoelectron angular distributions are reported for the (2+1) REMPI of the C ^{3}Pi/sub g/($3s\sigma$/sub g/), v' = 0—3 Rydberg levels of O_2. Ionization transitions leading to different vibrational final states (v^+) of $O^+{}_2$ exhibit markedly different angular distributions, suggesting different ionization mechanisms. The experimental data are qualitatively reproduced by very recent ab initio calculations which attribute the non-Franck—Condon behavior to the presence of a $k\sigma$/sub u/ shape resonance imbedded in the ionization continuum. Much of the remaining anomalous behavior is attributed to a Fano-type resonance in the Pi/sub u/ channel.

49207 **State-to-state reaction dynamics: A crossed molecular beam study of the reaction $CH(^2Pi_i$/sub $//_2;N = 1)+D_2\rightarrow CD(^2Pi$/sub 1/2,3/2/;N')+HD.** Liu, K.; Macdonald, R.G. (Gas Phase Chemical Dynamics Group, Chemistry Division, Argonne National Laboratory, 9700 South Cass Ave., Illinois 60439). *Journal of Chemical Physics;* **89**: No. 7, 4443-4444(1 Oct 1988).

The title reaction was studied in a new crossed molecular beam apparatus. Laser-induced-fluorescence was used to characterize both the reactant CH radical and the product CD radical in a state-resolved manner. Two types of dynamical information are reported here: (1) the excitation function for a specific reaction prod-

uct state and (2) the product rotational state distribution at a well-defined collision energy.

49208 Fluorination of the high-T/sub c/ superconductors $YBa_2Cu_3O_{7-\delta}$ and $GdBa_2Cu_3O_{7-\delta}$. Sauer, N.N.; Garcia, E.; Martin, J.A.; Ryan, R.R.; Eller, P.G.; Tesmer, J.R.; Maggiore, C.J. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Materials Research;* 3: No. 5, 813-818(Sep 1988).

Powdered samples of the high-temperature superconductors $ABa_2Cu_3O_{7-\delta}$ (A = Gd,Y) were treated with fluorine gas (100 Torr) at room temperature and 400 °C for varying times (12—64 h). Magnetic shielding measurements on fluorinated products showed that the superconducting volume fraction in treated samples was greatly reduced or even completely eradicated. All samples were structurally characterized by x-ray powder diffraction. Two yttrium samples, one fluorinated at 25 °C and one at 400 °C, were also examined by neutron powder diffraction. For samples treated at room temperature, no change in the structure or composition of the products was apparent by either technique. However, samples fluorinated at 400 °C are tetragonal, with a = 3.8641(3), c = 11.704(1) A, and bulk composition corresponding to the formula YBa_2Cu_3F/sub 3.5/O/sub 4.5/. Nuclear activation analysis, nuclear reaction analysis, and Auger spectroscopy were used to determine fluorine concentration and distribution in the fluorinated materials. For samples treated at room temperature, fluorine was found primarily within approximately 1 μm of the surface of the product particles. No evidence for a fluorine-containing superconducting phase was found in any sample; fluorine was found to be detrimental to superconductivity in all cases. These results suggest that the 123 oxides are sensitive to surface effects.

49209 Neutron powder diffraction study of the products from fluorinating $YBa_2Cu_3O_{7-\delta}$ at room temperature and at 400 °C. Garcia, E.; Sauer, N.N.; Ryan, R.R.; Williams, A.; Eller, P.G. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Materials Research;* 3: No. 5, 819-824(Sep 1988).

Fluorination of $YBa_2Cu_3O_{7-\delta}$ at room temperature results in no change of the critical temperature but a drastic reduction of superconducting volume fraction as determined by magnetic flux exclusion measurements. Rietveld refinement of neutron powder diffraction data indicates that the bulk structure has not changed in any significant way despite the loss of superconductivity. In marked contrast, when the superconducting oxide is fluorinated at 400 °C, a structural transformation from orthorhombic to tetragonal symmetry occurs that is accompanied by essentially complete filling of eight of the nine perovskite anion sites and total loss of superconductivity above 7 K. Interpretation of neutron activation analysis and neutron diffraction results render the formula of the fluorinated product as YBa_2Cu_3F/sub 3.5/O/sub 4.5/, but fluoride ions in the unit cell were not distinguished from oxide ions.

49210 Liquid membrane coated ion-exchange column solids. Barkey, D.P. (to Dept. of Energy, Washington, DC). US Patent 4,747,949. 31 May 1988. Filed date 23 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A process for separating metal ions from an aqueous solution is described comprising the steps of: providing confined cation exchange beads coated with a substantially hydrophobic, removable liquid membrane, the liquid membrane including a carrier compound effective to complex with the cations and to permit the transport of the cations through the membrane and onto the beads; contacting the confined beads with an aqueous solution having cations therein, the cations selected from the group consisting of copper, chromium, zinc, lead, nickel, cobalt, tungsten, palladium and mercury, for a sufficient time to permit the cations to permeate the membrane and be bound by the beads; and, separating the aqueous solution from the beads and thereafter extracting the cations from the beads.

49211 Ultraviolet light absorbers having two different chromophors in the same molecule. Vogel, O.; Li, S. (to Dept. of Energy, Washington, DC). US Patent 4,745,194. 17 May 1988. Filed date 6 Oct 1983. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

Ultraviolet light absorbing compounds having two different chromophors in the same molecule, particularly the benzotriazole chromophor and either the dihydroxybenzophenone or dihydroxyacetophenone chromophor; specifically, the two compounds 3,5-[di(2H-benzotriazole-2-yl)]-2,4-dihydroxyacetophenone and 3,5-[di(2H-benzotriazole-2-yl)]2,4-dihydroxybenzophenone.

49212 Electron capture negative ion mass spectra of halogenated diphenylethane derivatives. Stemmler, E.A.; Hites, R.A. (Indiana Univ., Bloomington (USA)). *Analytical Chemistry;* 60: No. 8, 787-792(15 Apr 1988).

The methane, electron capture, negative ion mass spectra of 17 halogenated diphenylethane, -ethane, and -ethanol derivatives (such as DDT, DDE, and dicofol) are reported. These three groups of compounds show spectral differences which reflect the nature of the base molecular structure. The diphenylethenes, where the ethene groups provides conjugation between the aromatic rings, give intense molecular ions and $[M - Cl]^-$ ions. Chlorine substitution on the aromatic ring is necessary for molecular ion stability. The diphenylethanes give complex spectra and weak molecular ions as a result of their aliphatic character. The halogenated diphenylethanols also show significant fragmentation. Molecular ions and characteristic ions that correspond to the dihalobenzophenone anion are observed. The spectra of these compounds are sensitive to isomeric substitution patters; for example, para,para' vs ortho,para' isomeric pairs can be differentiated.

49213 An EXAFS study of pyrolyzed metal macrocyclic electrocatalysts. McBreen, J.; O'Grady, W.E.; Sayers, D.E.; Yang, C.Y.; Pandya, K. (Dept. of Applied Science, Brookhaven National Lab., Upton, NY (US)). pp 182-197 of Electrode materials and processes for energy conversion and storage. Srinivasan, S.; Wagner, S.; Wroblowa, H. Pennington, NJ; The Electrochemical Society (1987). (CONF-8705216—).

From 2. symposium on electrode materials and processes for energy conversion and storage; Philadelphia, PA, USA (11 May 1987).

Pyrolysis of iron and cobalt N/sub 4/-chelates on carbon greatly improves their electrocatalytic activity and stability for oxygen reduction. The best results have been obtained by pyrolysis of absorbed iron and cobalt tetramethoxyphenyl porphyrins (TMPP) on carbon. A knowledge of the structure of these electrocatalysts could point the way toward the development of low cost substitutes of platinum. This paper reports an EXAFS study of pyrolyzed Fe-TMPP and Co-TMPP on Vulcan XC-72 carbon at several temperatures. Pyrolysis yields a mixture of metal, metal oxides and residual metal macrocycle. The presence of the latter is often masked by the metal and the oxide. Chemical leaching of the material to remove these simplifies spectroscopic studies on the residual macrocycle. In the case of Fe-TMPP EXAFS reveals a residual Fe-N/sub 4/ species even for pyrolysis temperatures as high as 1000°C. Residual Co-N/sub 4/ species were found for Co-TMPP at temperatures below 800°C. Above 900°C the Co-TMPP is completely reduced to the metal. At intermediate pyrolysis temperatures (600°C - 800°C) the pyrolyzed Co-TMPP is hydriophobic in KOH.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 48975, 49213, 49498

49214 Chloride poisoning of the oxygen reduction process at a bare and at a Nafion-coated platinum electrode. Paffett, M.T.; Redondo, A.; Gottesfeld, S. (Los Alamos National Lab., Los Alamos, NM (US)). pp 268-282 of Electrode materials and processes for energy conversion and storage. Srinivasan, S.; Wagner, S.; Wroblowa, H. Pennington, NJ; The Electrochemical Society (1987). (CONF-8705216—).

From 2. symposium on electrode materials and processes for energy conversion and storage; Philadelphia, PA, USA (11 May 1987).

The authors measured the rate of the oxygen reduction reaction at a Pt rotating disk electrode during the controlled dosing of the Pt surface by halide ions. Since the coverage by the impurity is

exactly known under the conditions of such experiments (provided halide adsorption is diffusion controlled), it is possible to obtain directly experimental plots of i/sub orr/ vs Θ/sub imp/. Such plots have been analyzed during controlled dosing by chloride and bromide, and were found to exhibit characteristic signoidal shapes, corresponding to slight sensitivity of i/sub orr/ to coverage by the impurity below Θ/sub imp/ = 0.10 and to a strong decay of i/sub orr/ as Θ/sub imp/ reaches 0.10 - 0.20. Attempts to simulate such behavior, assuming site-blocking according to either 1-Θ or to (1-Θ)/sup 2/ terms, failed to produce such sigmoidal curves of i/sub orr/ vs Θ/sub imp/ for either Langmuir or Frumkin halide-ion adsorption isotherms. The strong decay of i/sub orr/ at Θ/sub Cl// sup -/ or Θ/sub Br//sup -/ of ca. 0.1 seems to be due to a long-range (possibly electronic) effect. The authors also tested the sensitivity of a Pt electrode coated by a recast Nafion film to the presence of halide ions outside the film. They found that the penetration of halide ions through the Nafion coating is sufficiently slow to cause apparent beneficial effects under typical RDE experimental conditions. However, the Nafion film is not an effective barrier to halide ions under prolonged exposure conditions.

4005 Photochemistry

REFER ALSO TO CITATION(S) 49183, 49218

49215 (CONF-8806189—1) Laser-induced photodissociation of $Al_2(CH_3)_6$: Gas-phase and adsorbed layer dissociation mechanisms for Al film growth. Lubben, D.; Motooka, T.; Wendelken, J.F.; Greene, J.E. (Illinois Univ., Urbana (USA). Coordinated Science Lab.; Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014554/JAW.

From NATO workshop on mechanisms of reactions of organometallic compounds with surfaces; St. Andrews, UK (22 Jun 1988).

We describe the results of recent experiments investigating the photodissociation of TMA ($Al_2(CH_3)$) adsorbed on Si surfaces using high-resolution electron energy loss spectroscopy (HREELS) and Auger electron spectroscopy (AES). Stable single layers of TMA were formed at temperatures T(sub s) ~ 200 K, and the HREELS spectra are consistent with TMA being adsorbed with the Al-Al axis orthogonal to the Si surface. 26 refs., 7 figs., 2 tabs.

49216 Optically driven surface reactions: Evidence for the role of hot electrons. Buntin, S.A.; Richter, L.J.; Cavanagh, R.R.; King, D.S. (Center for Chemical Physics, National Bureau of Standards, Gaithersburg, Maryland 20899). *Physical Review Letters;* **61**: No. 11, 1321-1324(12 Sep 1988).

Evidence is presented for the role of excited conduction electrons in the laser-induced desorption of NO from Pt(111). State-specific detection of the desorbed NO establishes that the rotational distributions are non-Boltzmann, the spin-orbit population is inverted, and that both the translational and vibrational distributions are uncorrelated with the laser-induced surface-temperature jump. The role of optically excited substrate electrons in driving the desorption process is evidenced by a dramatic dependence of the vibrational and translation energy distributions on the desorption-laser wavelengths.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 49117, 49118, 49119, 49221

49217 (AD-A—193467/8/XAB) Radiation sensitivity of select metal chelate polymers: mechanistic changes at higher energies. Technical report. Archer, R.D.; Hardiman, C.J.; Lee, A.Y. (Massachusetts Univ., Amherst (USA). Dept. of Chemistry). 1 Oct 1987. 12p. (TR—11). NTIS, PC A03/MF A01.

Based on uranyl photochemistry in the visible/ultraviolet region, uranyl carboxylates are known to undergo CO_2 evolution; however, with gamma radiation (cesium-137, 662 keV) a sizable number of uranyl dicarboxylate polymers crosslink with high efficiency and without CO_2 evolution. On the other hand several dicarboxylates with sulfur in the organic backbone exhibit very high scission efficiency. G values in excess of normal organic resists is related to the heavy-atom content of these metal coordination polymers.

49218 (DOE/ER/00038—3107) Radiation Laboratory, University of Notre Dame: Quarterly report, April 1–June 30, 1988. (Notre Dame Univ., IN (USA). Radiation Lab.). 29 Jul 1988. Contract AC02-76ER00038. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015476/JAW.

Forty-six abstracts are included of research on various topics in radiation chemistry and photochemistry. (DLC)

49219 (INIS-mf—11291) 21. Brdicka days of radiation chemistry. Abstracts of papers and posters. Prasil, Z. (Ceskoslovenska Akademie Zemedelskych Ved, Prague. Ceskoslovenska Spolecnost Chemicka). Oct 1987. 115p. (In Czech and Slovak). (CONF-8711218—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88703909/JAW.

From 21. Brdicka days of radiation chemistry; Kuparovice, Czechoslovakia (9 Nov 1987).

The conference proceeded in four sessions. Session 1 dealt with radiolysis of compounds, with photochemically and radiation-induced reactions and heard papers that could not be included in the other sessions. Session 2 discussed the ionizing radiation effect on polymers and the properties of radiation cross-linked polymers. Session 3 heard papers on radiation sources and on studies of the ionizing radiation effect on semiconductors. Main attention was devoted to different types of radiation dosemeters. Session 4 discussed the applications of radiation technologies in forestry and water management, radiation sterilization of drugs and irradiation of foods. The proceedings only contain the abstracts of submitted papers. In some cases where no abstract has been submitted, only the title is shown. (E.S.).

49220 Method for detecting and correcting for isotope burn-in during long-term neutron dosimetry exposure. Ruddy, F.H. (to Dept. of Energy, Washington, DC). US Patent 4,749,866. 7 Jun 1988. Filed date 18 Aug 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for detecting and correcting for isotope burn-in of an interfering isotope in a fissionable deposit of a selected fissionable isotope during long-term exposure for neutron field dosimetry, wherein the interfering deposit has a known fission rate, the method is described comprising the steps of: (a) exposing the fissionable deposit to the neutron field for the long-term exposure; (b) determining the amount of the interfering isotope present in the fissionable deposit after the long-term exposure; and (c) using the known fission rate of the interfering isotope and the determined amount of the interfering isotope to determine the contribution to the total number of fissions of the fissionable deposit from the burn-in of the interfering isotope during the long-term exposure.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 48510, 49019, 49020, 49251, 49638, 49645

49221 (DP-MS—88-26) Effects of organic material on carbon aging. Hyder, M.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). [1988]. Contract AC09-76SR00001. 11p. (CONF-880815—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015393/JAW.

From 20. DOE/NRC nuclear air cleaning conference; Boston, MA, USA (22 Aug 1988).

Activated carbon is used in the confinement systems for the Savannah River Plant reactors to retain elemental or organic radioiodine in the reactor building effluent air. In this application it is exposed to an airflow of seven or eight bed volumes per second for many months. During this time, its ability to retain organic iodine slowly degrades, as a result of reactions with air and airborne materials. At these flow rates, even small traces of impurities in the air can have an important cumulative chemical effect over the service life of the carbon. The studies reported here were undertaken to

determine the practical importance of organic accumulation as compared to other aging mechanisms. In addition, the effect of organic accumulations on the radiolytic release of iodine was investigated. Three types of investigation were conducted. In the first, the amount of organic material accumulated on carbon during service was measured in a large number of carbon samples from the reactor confinement system, using liquid extraction and quantitative gas chromatography. The second set of experiments dealt with a single compound, bromotrifluoromethane ({open←quotes}Halon{ close←quotes}{reg←sign}), a fire extinguishing agent used in large quantities in automatic protective equipment in the reactor building. Its possible persistance on the carbon following a release was of concern because of the quantities involved. The loading and release of this compound from new and used carbons was measured experimentally. Finally, the effect of organics on the release of iodine from carbon in a radiation field was investigated. The release of organic iodine from a variety of carbon samples was measured before and after the addition of iodine to the carbon. The experiments included studies in which this was measured before and after adding organic material to the samples. 10 refs. 5 figs., 5 tabs.

49222 (INIS-BR—1147-Vol.), pp 437-441) **Determination of a radiochemical procedure for obtaining strontium titanate.** Cunha, I.I.L.; Andrade e Silva, L.G. de. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A research that aims to develop radiochemical procedures for the separation and solidification of /sup 137/Cs and /sup 90/Sr from fission products solutions has been carried out at the Radiochemistry Division of IPEN CNEN/SP. In a previous paper/sup (1/), a schematic outline of the process steps for the separation of /sup 90/Sr from fission products mixture was shown. In the present paper, the experimental conditions for solidification of strontium as strontium titanate have been studied. According to literature data, this compound offers the most suitable chemical form to use /sup 90/Sr as beta rays source.

49223 (INIS-BR—1147-Vol.3, pp 181-187) **Preparation, purification and storage of radioinsulin.** Toledo e Souza, I.T. de; Giannella Neto, D.; Wajchenberg, B.L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Stoichiometric iodination of porcine insulin was performed to the general method of Hunter and Greenwood with modifications recommented by Roth. These method was compared with radioiodination using Iodogen. Films of Iodogen react rapidly in the solid phase with aqueous mixtures of I and proteins. For two methods satisfactory activity of the labeled porcine insulin was obtained and the characteristics of the radioimmunoassay were studied.

49224 (INIS-BR—1147-Vol.3, pp 219-222) **Preliminary clinical assays with /sup 123/I produced by the Nuclear Engineering Institute-CNEN/RJ.** Maliska, C.; Pinto, J.C.M.; Pellegrini, P.M.; Frankenfeld, T.G.P.; Cruz, M.G.A.; Maliska, C.M.; Marinho, J.C.A.; Lima, J.E.T.; Costa, A.J. (Hospital Central do Exercito, Rio de Janeiro (Brazil). Servico de Medicina Nuclear). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Since the begining of regular production by the IEN - CNEN RJ, in 1986, the I/sup 123/ has been assayed by a joint protocol by the Nuclear Medicine Services of the Hospital Central do Exercito and Hospital Unversitario Clementino Fraga Filho of the Federal University of Rio de Janeiro. The results of the first 112 uptake of I-123 were comparable to those obtained by the I-131 and images obtained at 4th and 6th hours was similar or better than the 24th hours.

49225 (INIS-BR—1147-Vol.3, pp 233-238) **Implantation of centralized radiopharmacy laboratory.** Boasquevisque, E.M.; Maciel, O.S.; Souza, J.E.Q. de; Bernardo Filho, M. 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Several radiopharmaceuticals kits have been produced to be labeled with Tc-/sup 99m/ for used in Nuclear Medicine routine. However the price of these kits are expensive. The Radiopharmacy Laboratory of Image Integrated Program of the Campanha Nacional de Combate ao Cancer was implanted with purpose to manufacture kits to be distributed to various Institutions.

49226 (INIS-BR—1147-Vol.3, pp 239-244) **Proposal of a centralized radiopharmacy laboratory.** Boasquevisque, E.M.; Maciel, O.S.; Souza, J.E.Q. de; Bernardo Filho, M. 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

It is presented a proposal of a Centralize Radiopharmacy Laboratory that manufacured and labeled radiopharmaceuticals kits with Tc-99m and distributed them to the various Institutions.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 48142, 49020

49227 **(EPRI-EL—5952) Pyrolysis and combustion of oils contaminated with polychlorinated biphenyls and tri- and tetrachlorobenzenes.** Eadon, G.; Narang, A.; Narang, R.; Aldous, K.; O'Keefe, P.; Smith, R.; Briggs, R. (Electric Power Research Inst., Palo Alto, CA (USA); Health Research, Inc., Albany, NY (USA)). Aug 1988. 84p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015244/JAW.

Since the 1981 fire at the New York State Office Building in Binghamton, production of polychlorinated dibenzofuran (PCDF) and polychlorinated dibenzo-p-dioxin (PCDD) from fires in utility transformers containing askarels has been a national concern. The present report examines fires involving transformer fluids contaminated with lower levels of polychlorinated biphenyl (PCB) or tri/tetrachlorobenzene (TCB), showing that such fires would produce far less PCDF and PCDD than would askarel fires. 16 figs., 29 tabs.

42 ENGINEERING

REFER ALSO TO CITATION(S) 50325

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 48103, 48192, 48198, 48288, 48309, 48416, 48712, 48888, 48909, 49009, 49063, 49383, 49384, 49442, 49478, 49481, 49832, 50032, 50072, 50109, 50238, 50239, 50297

49228 **(AD-A—192461/2/XAB) Annotated bibliography for gas-mask and chemical-defense-gear related papers. Interim report.** Kelly, T.L.; Sucec, A.A.; Englund, C.E. (Naval Health Research Center, San Diego, CA (USA)). 15 Jan 1988. 49p. (NHRC—88-7). NTIS, PC A03/MF A01.

This is an annotated bibliography of papers that relate to the characteristics and effects of gas masks and other chemical-defense gear. Psychological, physiological, and cognitive performance effects are included.

49229 **(AD-A—192956/1/XAB) Equipment for an advanced electron-beam lithography system. Final report, 13 July 1986-14 July 1987.** Lukens, J. (State Univ. of New York, Stony Brook (USA). Dept. of Physics). 14 Jul 1987. 4p. NTIS, PC A02/MF A01.

Equipment has been purchased under this grant to develop and build a research electron beam lithography (EBL) system at Stony Brook for the support of research projects on superconducting electronics. The system is based on an array scanning electron microscope (SEM) which was modified to accept a laser interferometer to monitor stage position. High-precision nonmagnetic stages have been added, and interface electronics were designed and built to permit control of the beam position and beam blanking by an external computer. The completed system is designed to write over a four-inch wafer with a resolution of 30 nm and a positional accuracy of 100 nm.

49230 **(AD-A—192959/5/XAB) Equipment for building and testing superconductive-flux-flow electronic devices. Final report, 1 November 1986-30 November 1987.** Nordman, J.E.; Beyer, J.B. (Wisconsin Univ., Madison (USA). Dept. of Electrical and Computer Engineering). 30 Nov 1987. 4p. NTIS, PC A02/MF A01.

The equipment authorized by the grant is a thin-film vacuum deposition system containing provisions for ion-beam and magnetron sputter deposition and for ion-beam etching.

49231 **(AD-A—193123/7/XAB) Superconducting thin films, composites, and junctions. Final report, 1 May 1987-31 October 1987.** Geballe, T.H. (Stanford Univ., CA (USA). Dept. of Applied Physics). 25 Nov 1987. 9p. NTIS, PC A02/MF A01.

The successful synthesis of high-Tc $YBa_2Cu_3O_7$ films by means of electron beam codeposition was accomplished. Several important growth parameters were surveyed in a preliminary way. The substrates investigated include Al_2O_3, ZrO_2, MgO and $SrTiO_3$. The films were characterized by resistivity measurements, x-ray diffraction, microprobe, and Rutherford backscattering analysis. Some TEM and critical-current-density studies were also carried out. The best results to date have been obtained on $SrTiO_3$ substrates with which polycrystalline epitaxial growth has been achieved. Resistive superconducting transitions with zero resistance at 89.5K and a 2K width were observed in these films.

49232 **(AD-A—193330/8/XAB) Research into the architecture of CAD-based robot-vision systems. Final report, May 1984-31 October 1987.** Mudge, T.N.; Volz, R.A. (Michigan Univ., Ann Arbor (USA)). 9 Feb 1988. 8p. NTIS, PC A02/MF A01.

The research conducted under this grant investigates techniques for recognizing objects partially hidden or occluded. It was assumed that geometrical data about the objects was available either as a by-product of the CAD process used to design the object or as the output of a training phase. There were three aspects to this work. First, recognition techniques were developed that used only a single-view gray-level image. Second, complementary techniques were developed that used range images. Third, computation times for both of these techniques were studied with the intent of reducing them through the use of parallel processing. The work on gray-level images resulted in a number of new techniques to speedup recognition. These included the concept of saliency and critical point neighborhood, and a fast matching algorithm based on k-d trees. Techniques for recognizing occluded objects that can be at varying distances from the viewer were also developed. The work with range data was aimed at the recognition and pose estimation of three-dimensional industrial parts. The major subproblems addressed were: (1) segmentation and surface-parameter extraction, (2) grouping regions into a set (a Convex Region Set), and (3) Convex Region Set matching. The work to develop fast parallel versions of the recognition algorithms made extensive use of a 64-processor NCUBE hypercube multiprocessor. Speedups of 30:1 over VAX 11/780 implementations were obtained for some of the low-level image-processing algorithms used in the work.

49233 **(AD-A—193361/3/XAB) Method for locating a small magnetic object in the human body.** Kaufman, L.; Williamson, S.J.; Ilmoniemi, R.J.; Weinberg, H.; Boyd, A.D. (New York Univ., NY (USA)). 29 Feb 1988. 15p. NTIS, PC A03/MF A01.

A piece of a thin acupuncture needle lodged under the right scapula of a patient could not be found in surgical procedures accompanied by studies of 30 standard x-ray images. To locate it, the authors mapped the magnetic-field component normal to a plane lying above the object, using a superconducting quantum interference device (SQUID). Assuming that the needle could be modeled as a magnetic dipole, the authors were able to infer its lateral position, depth, orientation, and magnetic moment. With this information, directed CT scans, high-resolution x-ray films, and the subsequent surgical removal of the needle proved that it could be located in the body with an accuracy of about three millimeters.

49234 **(AD-A—193680/6/XAB) Design and development of the AFGL Vibro-Acoustic Measurement System. Final report.** Michel, H.E. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 24 Apr 1987. 34p. (AFGL-TR—87-0195). NTIS, PC A03/MF A01.

The Vibro-Acoustic Measurement System is a distributed computer network designed for monitoring environmental motions. The heart of the system is a master-control unit to centrally manage the network as well as to continually record data. Closely coupled to the master is an array processor for the massively parallel data processing required in digital signal processing. Five slave units are coupled to the master. Each slave can handle 16 sensors; the system capacity is 80 channels. The network will function using only one voice-grade telephone line between the master and each slave.

49235 **(AD-A—193815/8/XAB) SQUID (Superconducting Quantum Interference Device) arrays for simultaneous magnetic measurements: calibration and source localization performance. Report for September 1986-February 1988.** Kaufman, L.; Williamson, S.J.; Costa Ribeiro, P. (New York Univ., NY (USA)). 29 Feb 1988. 26p. NTIS, PC A03/MF A01.

Recently developed small arrays of SQUID-based magnetic sensors can, if appropriately placed, locate the position of a confined biomagnetic source without moving the array. The authors present a technique with a relative accuracy of about 2% for calibrating such sensors having detection coils with the geometry of a second-order gradiometer. The effects of calibration error and magnetic noise on the accuracy of locating an equivalent current dipole source in the human brain are investigated for 5- and 7-sensor probes and for a pair of 7-sensor probes. With a noise level of 5% of peak signal, uncertainties of about 20% in source strength and depth for a 5-sensor probe are reduced to 8% for a pair of 7-sensor probes, and uncertainties of about 15 mm in lateral position are reduced to 1 mm, for the configuration considered.

49236 **(AD-A—193890/1/XAB) Evaluation of design concepts for tents with CW protection requirements. Final report, October 1982-September 1985.** Steeves, E.C. (Army Natick Research Development and Engineering Center, MA (USA)). Sep 1987. 51p. (NATICK/TR—88/023). NTIS, PC A04/MF A01.

The implementation of the analytic hierarchy process for the evaluation of tent design concepts is described. A hierarchy made up of the following four levels is used: function to be sheltered, operational factors, design requirements, and alternative design concepts. The evaluation was performed by a team of tentage experts in the development community. Instead of considering complete tent concepts, the evaluation was performed on alternative design concepts for the structural support, barrier material, and chemical protection components of a tent. The evaluation found that the most acceptable concepts are the pressurized-rib concept for structural support, the laminated-fabric film for the barrier material, and the integrated environmental/chemical barrier for chemical protection.

49237 **(CONF-880547—3) Electron beam welding produces improved duplex crack arrest specimens.** King, J.F.; Hudson, J.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88003885/JAW.

From ASM/EWI power beam conference; San Diego, CA, USA (1 May 1988).

The crack arrest toughness, K/sub Ia/, is generally determined using a monolithic compact type specimen which contains a

brittle weld bead to act as a crack initiation site. To test at higher temperatures and toughnesses, electron beam (EB) welded duplex specimens were fabricated. These specimens required the joining of hardened 4340 steel, which acts as the crack initiator, to A533 grade B class 1 steel base material and submerged arc welds in this base metal. The successful fabrication of these specimens required the development of an EB welding procedure with a very narrow heat-affected zone (HAZ). A technique was also developed to eliminate the porosity which was always present in the EB welds through the submerged arc weld deposit region of the joint. The technique involved remelting the joint surface of the A533 steel containing the submerged arc weld to a controlled depth using an oscillated electron beam. This remelt in vacuum reduced the gaseous constituents to low levels and prevented porosity from forming in the deep penetration EB welds between this surface and the 4340 steel.

49238 **(CONF-8806170—11) Design strategy for the cryogenic DT [deuterium-tritium] pressure system at LANL.** Mruzek, M.T.; Musinski, D.L. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1988. Contract AC03-87DP10560. 23p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013015/JAW.

From 6. target fabrication specialist's meeting; Los Alamos, NM, USA (19 Jun 1988).

Using cryogenics to increase the pressure of deuterium-tritium gas is a conceptually simple process. The source of DT gas is maintained at room temperature and near atmospheric pressure. The pressure intensifier is isolated from the gas source with a valve. During operation the intensifier is cooled with liquid helium and the isolation valve is opened. Accordingly, DT gas condenses out as liquid in the cold intensifier vessel. The isolation valve is subsequently closed and the refrigeration withdrawn. Upon warming the trapped DT liquid changes state and produces high pressure gas. Cryogenic pressure intensifying has several unique advantages over the use of mechanical compressors. One advantage is the complete elimination of oil and lubricant contamination in the process gas. 3 figs.

49239 **(CONF-8806183—1) Telerobotic control of the seven-degree-of-freedom CESAR manipulator.** Babcock, S.M.; Dubey, R.V.; Euler, J.A.; Glassell, R.L.; Kress, R.L.; Hamel, W.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012937/JAW.

From NATO advanced research workshop on robots with redundancy: design, sensing, and control; Salo, Italy (27 Jun 1988).

The application of a computationally efficient kinematic control scheme for manipulators with redundant degrees of freedom to the unilateral telerobotic control of seven-degree-of-freedom manipulator (CESARM) at the Oak Ridge National Laboratory Center for Engineering Systems Advanced Research is presented. The kinematic control scheme uses a gradient projection optimization method, which eliminates that need to determine the generalized inverse of the Jacobian when solving for joint velocities, given Cartesian end-effector velocities. A six-degree-of-freedom (nonreplica) master controller is used. Performance indices for redundancy resolution are discussed. 5 ref., 6 figs.

49240 **(CONF-8809108—1) Prototype data acquisition and analysis system for Navy operational flight simulators.** Muller, R.C.; Allgood, G.O.; Van Hoy, B. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02. Order Number DE88014557/JAW.

From American Institute of Aeronatics and Astronautics simulation technology conference; Atlanta, GA, USA (7 Sep 1988).

A problem of flight simulators has been the discomfort experienced by some pilots to the point of nausea. Likely explanations are a significant lack of synchronization between sight and movement as well as motion in the critical frequency magnitude region. A program to examine this problem has been undertaken at Oak Ridge National Laboratory, and the selection of appropriate computer hardware and software for analyzing motion and visual systems in real time is described. While requirements such as high data acquisition rate and high rates of arithmetic operations have driven the sections, rapid advances in computer technology have guided system development toward easy upgrade at modest cost. Results from use and demonstration have been positive, especially in the areas of reliability and ease of use.

49241 **(CRIE-T—87001) Power system stability improvement by superconducting generator.** Taniguchi, Haruhito; Ogawa, Tetsuji. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Sep 1987. 38p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753440/JAW.

This report arranges the results of researches which were conducted by Electric Power Central Institute until the summer of 1987, on power system stability improvement effects by the introduction of superconducting generators and clarifies the points to be borne in mind from the viewpoint of system stability upon the introduction of superconducting generators into power supply systems and the effects restraining transient voltage fluctuation of the systems. Concerning the power system stability improvement effect of the power supply system, a superconducting generator with its synchronous reactance (Xd) of 0.3 shows nearly 10% improvement of the critical transmission power without possible excitation control in comparison with the conventional generator which has the maximum excitation system now available (excitation ceiling 7PU, about 1,500V) in transmitting electricity over about 1,500 km. If high speed excitation is applied to it, the critical transmission power is improved by 20% at the excitation ceiling voltage of 600PU (about 3,000V) and 20-30% at the excitation ceiling voltage of 1,000PU (about 5,000V). For the high speed excitation, a power system stabilizer (PSS) is needed for a generator and a damper effect should be taken into consideration. The effect of restraining transient voltage fluctuation is not conspicuous. (28 figs, 13 tabs, 3 refs)

49242 **(DOE/ER/10386—1) Particle deposition in granular media: Annual progress report.** Tien, Chi. (Syracuse Univ., NY (USA). Dept. of Chemical Engineering and Materials Science). 1988. Contract AC02-79ER10386. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014624/JAW.

The topics of investigations carried out during this period are: (1) Granular Filtration in Moving Beds; (2) Collection of Charged Aerosols in Granular Beds; (3) Instrument Sensitivity in Filtration Measurements and (4) Magnetically Stabilized Fluidized Filters. The ultimate objective of the study is to obtain a quantitative understanding of the various phenomena associated with the deposition of particles in granular media, which can be used as a rational basis for the design of granular filtration systems. While the four investigations are carried out with this ultimate objective in mind, they are well-defined individual topics of study and consequently can be described separately as given below. 9 refs., 9 figs., 1 tab.

49243 **(DOE/MC/22134—2585) Conceptual design of commercial oil shale plants, fluidized bed retorting of Colorado oil shale: Alternate design study: Topical report.** Albulescu, P.; Mazzella, G. (Foster Wheeler USA Corp., Clinton, NJ). Nov 1987. Contract AC21-86MC22134. 186p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88001090/JAW.

A conceptual design and cost estimate were developed for an integrated oil shale process plant based on fluidized-bed retorting of Colorado oil shale with lift pipe combustion of retorted shale. The present study incorporates an alternate design for the fluidized-bed retorting system, similar to the configuration employed in fluid catalytic cracking designs. The modified retort design, which employs fluidized bed combustion of retorted shale and pneumatic transport of hot solids, was factored into the base case integrated plant. As in the base case study, the alternate plant design has a nominal capacity of 50,000 barrels per operating day of syncrude product, derived from oil shale having a Fischer Assay of 30 gallons per ton. The plant scope reflects a grassroots facility which receives run-of-mine oil shale, delivers product oil to storage, and disposes of the processed spent shale. Estimated investment costs and annual operating costs for the alternate plant design were developed. In addition, a technical and economic assessment

of the modified retorting design was made relative to the base case study. 9 refs., 7 figs., 30 tabs.

49244 **(DPST—86-262) Objective and independent review system for SRP [Savannah River Plant] nonreactor facilities.** Durant, W.S. (Savannah River Lab., Aiken, SC (USA)). 29 Jan 1986. Contract AC09-76SR00001. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014496/JAW.

The review system described in DPW-83-112 effectively provides objective and independent review for operation of SRP non-reactor nuclear facilities. Safe operation is ensured by trained personnel; an extensive system of Operational Safety Requirements, Technical Standards, written procedures and safety documents; incident investigation and reporting; and internal auditing. Implementation of DOE Order 5480.1A, Chapter V will be completed with issue of Operational Safety Requirements for all the non-reactor designated facilities in March 1986. 6 refs., 1 fig.

49245 **(EGG-CS—7233-Rev.2) The Simion PC/PS2 user's manual: Version 4.0.** Dahl, D. A.; Delmore, J.E. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1988. Contract AC07-76ID01570. 129p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88015112/JAW.

SIMION is an electrostatic lens analysis and design program originally developed by D.C. McGilvery at Latrobe University, Department of Physics and Chemistry, Bundoora Victoria Australia, 1977. The SIMON PC/PS2 version, developed at the Idaho National Engineering Laboratory, is an extensively revised version designed for highly interactive use on PC/PS2 class computers. Version 4.0 is the third major release of SIMION PC/PS2. Extensive algorithm modifications have dramatically improved this version's computational speed and accuracy. New features contained in this version include 3D modeling, potential energy surface displays, arbitrary direction magnetic fields, ability to incorporate user written programs, and compatibility with IBM Personal System/2 computers.

49246 **(FMPC—2150) Criticality safety training for fissile material workers.** D'Aquila, D.M. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). 1988. Contract AC05-86OR21600. 11p. (CONF-8806175—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013761/JAW.

From People to people delegation to the Peoples Republic of China; Beijing, China (15 Jun 1988).

Fissile material workers must receive criticality safety training as required by United States Department of Energy Order 5480.5, "Safety of Nuclear Facilities." Also, an American National Standard Institute standard has been proposed to establish guidelines for Nuclear Criticality Safety training programs for fissile material workers. The regulatory guidance for training programs will be discussed and selected portions of a training program for fissile material workers at a low enriched uranium metal fuel fabrication facility will be presented.

49247 **(IEE—8704) Application possibility of superconducting technology.** Nara, Yoshihiro; Kawasaki, Hiroshi. (Institute of Energy Economics, Tokyo (Japan)). 25 Nov 1987. 47p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753445/JAW.

Superconductivity is a phenomenon wherein electric resistance gets zero below a certain temperature, and is expected to accelerate the trend of economy towards the informational age and software, as well as refreshing the heavy and large industrial technology. Although the market size of direct products of superconductivity application is estimated as roughly 17 trillion yen in 2010, there is a mix-up in the possibilities between the superconductivity technology and the oxide-based superconducting substances which are presently footlighted; the latter still involves various problems for its industrialization. They are: Technical problems as temperature of superconductivity. Attaining high current density and magnatic field. Reliability and fabrication ability. In addition, there remains a problem of competition with other technologies. Item most advanced in Japan presently are superconducting power storage, power generation, and power transmission. Future possibility lies in the plasma sealing of nuclear fusion. (28 figs, 10 tabs)

49248 (INIS-BR—1147-Vol.2, pp 225-239) **Manipulator of radioactive materials.** Roberty, N.C.; Ornella, J.M.; Cunha, I.; Cunha, D.R. da. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia; BNDES, Rio de Janeiro (Brazil); Rio de Janeiro Univ. (Brazil). Inst. de Matematica). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Electrical-mechanical electric-dispositiva for human safety while manipulating radioactive materials and equipment, used in situations that could represent serious risks of life. This project consists of a programmable manipulator characterized by: Articulated links, six degrees of freedom, portability, remote control mobility, rechangeable end-effector and microprocessors operation.

49249 (INIS-BR—1147-Vol.2, pp 381-391) **Containment system of contamination in irradiated materials handling laboratories.** Lobao, A.S.T.; Araujo, J.A. de; Camilo, R.L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A study to prevent radiactivity release in lab scale is presented. As a basis for the design all the limits established by the IAEA for ventilation systems were observed. An evaluation of the different parameters involved in the design have been made, resulting in the specification of the working areas, ducts and filtering systems in order to get the best conditions for the safe handling of irradiated materials.

49250 **(INIS-mf—11751) Development of a plasma-arc-cutting technology like a mechanical saw for atmosphere and under water for dismantling nuclear components of greater thickness. Final report.** Bach, F.W.; Jaeger, M. (Hannover Univ. (Germany, F.R.). Inst. fuer Werkstoffkunde; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1987. 134p. (In German). NTIS (US Sales Only), PC A07/MF A01; GPO Dep. Order Number DE88754594/JAW.

Status of research: With the plasma arc cutting it is until now not possible to cut steel under water which is thicker than 100 mm. In a depth of water of 20 m it is only possible to cut steel up to 80 mm. This is not enough for the dismantling technology. Aim of research work: Plasma arc cutting technology should be developed to enable cutting a plate independent of its thickness. Method of research: A plasma-arc-saw has been developed for a thermal cutting of materials, similar to a mechanical saw. To develop and optimize the special nozzles of the plasma-arc-saw the submerged combustion burner has been developed parallel by the arc-saw. Results: There are no problems of thermal cutting a steel independent of its thickness. The thickness of the plate depends only on the diameter of the saw disc. The water depth of 20 m reduced the cutting speed of 10%. The plasma-arc-saw enables thermal cutting of a plate independent of its thickness in a water depth of 20 m without requiring a force. The remote controlled dismantling of a reactor vessel and other components with greater wall thickness is possible. (orig./HP) With 21 refs., 6 tabs., 87 figs.

49251 **(Juel-Spez—431) Description of the 370 TBq high-pressure tritium apparatus TRIBA.** Laesser, R.; Triefenbach, D.; Klatt, K.H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). Feb 1988. 98p. (In German). NTIS (US Sales Only), PC A05/MF A01; GPO Dep. Order Number DE88754601/JAW.

The apparatus is built according to the principle of multiple containment. The primary containment is an all metal UHV apparatus constructed using only tritium compatible materials. All components, where certain tritium-permeation due to high pressures and temperatures may occur, are surrounded by further volumes which are capable of retaining the tritium in case of leckage or break of the first wall. The whole apparatus is placed inside a secondary

containment which is constructed like a stainless steel glove box and contains an integrated tritium cleaning system. The 370 TBq tritium are stored in uranium tritide. In the sample chamber pressures up to 26 bar and temperatures up to 1000/sup 0/C can be obtained. For the preparation of metal tritide samples pressures in the range of 10/sup -7/ mbar are necessary which can be achieved by one turbomolecular- and two iongetterpumps, to reduce oxidation effects. In addition, the risks of tritium and further possibilities to charge metals with tritium are discussed.

49252 **(LA-UR—88-2421) Sulfur and selenium isotope separation by distillation.** Mills, T. R.; McInteer, B. B.; Montoya, J. G. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-880787—). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014392/JAW.

From 3. international symposium on the synthesis and applications of isotopically labeled compounds; Innsbruck, Austria (17 Jul 1988).

Sulfur and selenium isotopes are used for labeled compounds and as precursors for radioisotope production; however, both limited availability and high costs are problems. A new method is needed for large-scale separation of these isotopes. Experimental distillation columns were used to measure isotopic separations for sulfur and selenium compounds. The maximum total isotope separation of ^{32}S vs. ^{34}S were 1.127 for H_2S, 1.048 for COS, 0.838 for SF_4, and 1.058 for CH_3SH. Relative volatilities of ^{32}S vs. ^{34}S are 1.0006 for COS and 0.9976 for SF_4. There is a reverse isotope effect for carbon in COS. No isotopic separation was observed for dimethyl selenide. The lower mass selenium isotopes in H_2Se are more volatile. Distillation is a promising method for separating sulfur isotopes on a production scale. Existing distillation technology produced separated isotopes with an effect similar to that found for sulfur in SF_4. 8 refs., 2 tabs.

49253 **(LA-UR—88-2439) Calculation of subsequent structural effects after an accidental explosion in a test facility.** Fugelso, L.E.; Deeter, M.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-880891—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014394/JAW.

From 23. DOD explosives safety seminar; Atlanta, GA, USA (9 Aug 1988).

This paper presents an analysis of the deformation and potential damage to a critical component of an experiment at the flame source in a high intensity burner due to a small accidental explosion. First, the accident is briefly summarized. Then, upper and lower bounds for the explosive load are estimated. Next, a finite element model of one of the key structural components is generated and the simplifying assumptions are critically evaluated. Then the results of the appropriate finite element calculation are evaluated and the effect of the accident on the structure is presented. 6 refs., 7 figs.

49254 **(LA-UR—82117) High efficiency diffraction grating designs for rhomb configurations.** Wantuck, Paul J.; Appert, Quentin D.; Gratix, E. C.; Hopkins, A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 21p. (CONF-880887—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014413/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

A diffraction grading rhomb is an excellent candidate for both supressing sideband instabilities in a free electron laser and outcoupling the optical beam. A rhomb incorporating sinusoidal profile grating exhibits many of the required performance characteristics for such an application. We present in some detail a description of such a rhomb alignment sensitivity analysis. 6 refs., 8 figs.

49255 **(LBH—091982) Forces exerted on restraining structures by hog fuel piles. Final report.** Edwards, W.C.; Tam, P. (Levelton (B.H.) and Associates Ltd., Vancouver, British Columbia (Canada)). Sep 1982. 109p. (CE—01700). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Extensive experience has been gained with the design of retaining walls for soils and fill materials having a granular nature. However, doubt exists as to the applicability of this experience to the design of retaining walls for wood residues. Field tests were conducted under ordinary plant operating conditions to measure the lateral pressure imposed on a retaining wall by piles of wood residues in chipped and hogged form. The effects on lateral pressure of the height, shape and age of the pile, bulk density of the residues, and vehicle traffic on the pile were investigated. From tests with a conical green chip pile, lateral pressure was found to vary non-linearly with depth and to vary in differing proportion to depth, depending on the pile size. The coefficient of active horizontal pressure, k/sub ah/, was determined to decrease to 0.42 as the pile height above the lowest sensor reached 3 m. Values of k/sub ah/ were determined for hog fuel resting against a plane bin wall. Pressures varied non-linearly with depth, and also were dependent on pile size. Experimental values of k/sub ah/ were compared to theoretical values predicted by the coulomb equation for a wall with friction. The best comparison resulted when the internal friction angle was assumed near to the observed average surface slope of the pile. A series of tests were conducted by moving a small bulldozer parallel and perpendicular to a retaining wall in front of pressure sensors. Measured lateral pressures compared favorably with that predicted by theory at a depth of 0.681 m, but were considerably lower than the theorectical values at greater depths. Further work was recommended. 7 refs., 52 figs., 6 tabs.

49256 **(NP—8770379) Ceramic heat exchanger for industrial application. Final report.** Huber, J.; Schelter, H.; Foerster, S.; Quell, P.; Dibelius, G. (Hoechst CeramTec A.G., Selb (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.); Technische Hochschule Aachen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jan 1988. 162p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770379/JAW.

In this project, square prismatic shaped ceramic counter flow- and cross flow heat exchangers made from Reaction Bonded Silicon Nitride (RBSN) and silicon-infiltrated silicon carbide (SiSiC) have been developed and produced using lamination techniques. Such heat exchange devices could be used for e.g. recuperative heating of air, combustion of harmful gases and for applications in general and chemical techniques. Our activities were mainly focused on heat exchangers made from SiSiC. Concluding our works the aspects for counter flow heat exchangers are: Applicable as condensing domestic heater (media: gas/water) with a heat exchanger-performance (ϵ) near 100% at 15 KW and a gas entrance temperature of about 1600/sup 0/C. For cross flow heat exchangers are: The temperature range up to 500/sup 0/C (media: gas/gas) have been investigated in this study. But there are already some practice oriented applications at hot gas temperatures of above 1300/sup 0/C. (orig.) With 67 figs., 16 tabs., 12 refs.

49257 **(NUREG/CR—5090) Effects of temperature and humidity on respirator fit under simulated work conditions.** Skaggs, B.J.; Loibl, J.M.; Carter, K.D.; Hyatt, E.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Los Alamos National Lab., NM (USA)). Jul 1988. Contract W-7405-ENG-36. 39p. (LA—11236). NTIS, PC A03/MF A01 - GPO. Order Number TI88015233/JAW.

A study conducted at the Los Alamos National Laboratory compared quantitative fit factors and simulated work factors and determined the effects of temperature and humidity on respirator fit. This study used a commercially available fit chamber and an environmental chamber set at six conditions to simulate US work environments. Seven respirators were tested on a limited test panel of 10 subjects. The test results indicate that the performance of one

powered air-purifying respirator (PAPR) helmet is significantly degraded during the simulated work exercises, whereas the half-mask PAPR performance was not affected. Tight-fitting facepiece PAPRs provide higher protection than loose-fitting PAPRs. The performance of the negative-pressure half-mask and full-facepiece respirators is degraded during fit tests at high humidity and high temperature. The degradation of the fit factors for the negative-pressure half-mask during high humidity at ambient and high temperatures is probably due to facepiece slippage caused by sweating. More dynamic exercises, including motions in which the individual bends over and stands up repeatedly, are recommended to develop quantitative fit factors that adequately simulate work factors. Tight-fitting facepiece PAPRs should not be classified with loose-fitting PAPRs. 12 refs., 7 figs., 14 tabs.

49258 **(NUREG/CR—5154) Experimental assessment of damping in low aspect ratio, reinforced concrete shear wall structure.** Farrar, C.R.; Bennet, J.G. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Los Alamos National Lab., NM (USA)). Aug 1988. Contract W-7405-ENG-36. 39p. (LA—11325-MS). NTIS, PC A03/MF A01 - GPO. Order Number TI88015465/JAW.

This report summarizes the experimental data obtained from the Seismic Category 1 Structures Program concerning damping in low aspect ratio, reinforced concrete shear wall structures. This program, that is sponsored by the United States Nuclear Regulating Research, has tested 37 shear wall structures and structures and structural elements both statically (monotonic and cyclic) and dynamically (sine sweep, random, simulated seismic, and impulse). Data from these tests have been analyzed by four different methods to determine equivalent viscous damping ration that can be used in the analysis of shear wall structures. These methods are: (1) frequency response function analysis, (2) the log decrement method, (3) the hysteretic energy loss method, and (4) the flow response spectra matching method. The floor response spectra matching method is, to the author's knowledge, new and provides the most general method for assessing a variety of damping mechanisms. Results from the various methods were generally consistent and the damping values were found to be in the range specified by current regulatory guides. A discussion of the various damping mechanisms, how damping mechanisms affect the equations of motion, the effects of the type of loading on the various methods used to determine the damping, and other investigators' results are also presented. 22 refs., 15 figs., 11 tabs.

49259 **(PB—88-213582/XAB) Development of an improved permissible miners' caplamp. Open file report (Final) 1978-88.** Ferreira, E.; Charkey, A. (Energy Research Corp., Danbury, CT (USA)). Feb 1988. 87p. NTIS, PC A05/MF A01.

The report describes the design and development work performed to reduce the volume and weight of the miners' caplamp battery, as well as a headpiece with a swivel mechanism containing a halogen bulb with two filaments. Work was also conducted in the development of a maintenance-free battery. The design concept is based on nonsintered Ni-Cd technology, with an energy density of 22 Wh/lb. The caplamp system developed has been approved by the Mine Safety and Health Administration and can be manufactured for mine use.

49260 **(PB—88-866538/XAB) Sensors and detectors based on superconducting devices. January 1970-June 1988 (Citations from the Engineering Index data base). Report for January 1970-June 1988.** (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 168p. NTIS PC N01/MF N01.

Supersedes PB—87-861852.

This bibliography contains citations concerning gradiometers, magnetometers, and infrared detectors which use superconductors to improve sensitivity. Applications include biomagnetic measurements for medical studies, gravity-wave experiments, geomagnetism, and ocean-bottom magnetic exploration, galvanometers and voltmeters, and bolometers, and radiometers. Some articles refer to design considerations for cooling systems for the sensors and detectors, and fabrication techniques for squids (superconducting quantum interference devices.) (This updated bibliography contains 394 citations, 71 of which are new entries to the previous edition.)

49261 **(SAND—88-0545C) [The Radiation-Hardened Integrated Circuit (RHIC) Laboratory: Pursuit of Class 1.** DeWitte, M. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 12p. (CONF-880933—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006640/JAW.

From 9. annual international symposium on contamination control; Los Angeles, CA, USA (26 Sep 1988).

The Radiation-Hardened Integrated Circuit (RHIC) Laboratory is a research and development facility operated by Sandia National Laboratories for the Department of Energy. This report describes the features of the laboratory in detail. The facility is operated by the Center for Radiation-Hardened Microelectronics (CRM) and supports government clients with the rapid development and pilot production of radiation-hardened ULSI microelectronics. More than 25 years after Sandia's Willis Whitfield invented the first vertical laminar flow clean room, Sandia National Laboratories has once again taken the lead in clean room technology with the design and construction of the RHIC facility. The building was designed to support wafer fabrication of ULSI integrated circuits through the 1990's. The facility consists of 12,000 s.f. (net) Ultra-Clean Room in a bay and chase configuration. The 174,000 s.f. building houses the majority of the Sandia CRM with 62,000 s.f. dedicated to office and light laboratory, 46,000 s.f. allocated for the clean room bay, chase and equipment repair/service area with the remaining 66,000 s.f. required for central plant and process support space. 4 figs., 1 tab.

49262 **(SAND—88-0725C) The architectural ergonomics of Sandia's RHIC-II gowning facility.** Miller, D.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 14p. (CONF-880933—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88007427/JAW.

From 9. annual international symposium on contamination control; Los Angeles, CA, USA (26 Sep 1988).

Sandia National Laboratories is beginning to occupy the 5853 sq. meter (63,000 sq.ft.) light lab and office wing of a new complex. Sandia and its contractors will occupy the heavy-lab wing, approximately 2973 sq. meters (32,000 sq.ft.), of which 1161 sq. meters (12,500 sq.ft.) is Class 10 clean room. Once fully occupied and operating at full capacity, three shifts of approximately 45 process technicians will be working in the clean room. In order to maintain a Class-10 environment (fewer than 10 particles of 0.1-micron size or larger per cubic foot), clean room technicians will be required to wear special uniforms that filter the air exhaled by the wearer before passing it back into the clean room environment. This paper will describe the uniforms and associated equipment, the gowning sequence, and the facility designed to accommodate convenient, contamination-free gowning. 5 refs., 8 figs.

49263 **(SAND—88-0944) SALAD helicopter integrated sensor.** Soo Hoo, M.S. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 37p. NTIS, PC A03. Order Number DE88015413/JAW.

The theory and operation of an integrated acoustic and seismic sensor for use with the SALAD helicopter detection system is presented. This sensor incorporates a microphone, geophone, acoustic preamplifier, and tamper indicating features in a buryable, compact aluminum package. This sensor is intended for deployment within a pre-selected, controlled media.

49264 **(SAND—88-1060C) Comparison of mechanical and electronic high-speed recording systems.** Sweatt, W.C.; Phipps, G.S.; Shagam, R.N.; Hill, R.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 26p. (CONF-880887—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015264/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

Commercially available mechanical, video, and electronic high-speed imaging systems are compared as part of an attempt to

answer the question, will electronic cameras replace film cameras for high-speed recording? Of special interest is the relationship between spatial resolution and frame rate. Equally important is the compatability of the imaging systems for recording different types of experiments and tests. The resolution of a number of systems that represent various classes of framing cameras has been compared at their maximum framing rate. Included are several classes of mechanically advanced framing cameras, electronic streak cameras operated in a framing mode, and high-speed video systems. Likewise, the resolution of various classes of streak and image motion cameras has been compared at their maximum temporal resolution. The results: at frame rates up to 25 Mf/s, mechanical cameras can record from 10 to 100 times more data per frame and several times as many frames per run as existing electronic cameras, and from 100 to 1000 times more data per frame than existing video cameras. Video systems are limited in resolution and speed but provide instant access to data. Electronic cameras provide faster frame and streak rates than mechanical cameras (up to 600 Mf/s) but are limited in resolution. Neither of these "electronic" technologies is expected to replace mechanical technologies using CCD arrays, however, may result in devices that are more competitive with conventional film techniques.

49265 **(SAND—88-1715C) Selection and evaluation of video tape recorders for surveillance applications.** Martinez, R.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-880631—34). NTIS, PC A02. Order Number DE88014240/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Unattended surveillance places unique requirements on video recorders. One such requirement, extended operational reliability, often cannot be determined from the manufacturers' data. Subsequent to market surveys and preliminary testing, the Sony 8mm EVO-210 recorder was selected for use in the Modular Integrated Video System (MIVS), while concurrently undergoing extensive reliability testing. A microprocessor based controller was developed to life test and evaluate the performance of the video cassette recorders. The controller has the capability to insert a unique binary count in the vertical interval of the recorded video signal for each scene. This feature allows for automatic verification of the recorded data using a MIVS Review Station. Initially, twenty recorders were subjected to the accelerated life test, which involves recording one scene (eight video frames) every 15 seconds. The recorders were operated in the exact manner in which they are utilized in the MIVS. This paper describes the results of the preliminary testing, accelerated life test and the extensive testing on 130 Sony EVO-210 recorders.

49266 **(UCRL—21070) Solution methods for damped linear dynamic systems.** Chen, Harn-Ching. (Lawrence Livermore National Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Civil Engineering). Nov 1987. Contract W-7405-ENG-48. 120p. (UCB/SEMM—87/08). NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88013812/JAW.

This dissertation considers solution methods for damped linear structural systems which are subjected to transient loading. To accommodate a range of possible applications, the damping is assumed to be non-proportional to mass and stiffness and may also be large and/or lumped. Some important characteristic properties of the damped system are presented. The second-order equations of motion are reduced to a first-order set by doubling the size of the problem to facilitate the subsequent analysis and computation. The Rayleigh-Ritz method is generalized for the matrix pencil associated with a damped system. A projection method is discussed as an alternative. Both provide a basis for computing partial eigensolutions of a large damped dynamic system. The subspace iteration method is modified to extract eigensolutions of a damped dynamic system. The iteration vectors are arranged in such a way that only real arithmetic is required to describe the complex solution vectors. The algorithm is implemented to solve some typical numerical examples. The Lanczos method also is extended to find eigensolutions of a damped dynamic system. The loss of orthogonality between Lanczos vectors is investigated and two schemes are presented to restore the required orthogonality. The algorithm presented can take full advantage of the symmetry and sparsity of the associated matrices and also involves only real arithmetic during the solution process. The algorithm is implemented and tested with the numerical examples introduced in the subspace solution. 31 refs.

49267 **(WHC-SA—0107) Continuity of computer-aided drafting operations.** Jacobson, L.D. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1987. Contract AC06-87RL10930. 6p. (CONF-8709311—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014614/JAW.

From Association of Calma Users (ASCUS) conference; Burlington, MA, USA (29 Sep 1987).

The operating performance, operating procedures, and equipment added are discussed for the Computer Aided Drafting (CAD) operation at UNC Nuclear Industries before consolidation of operating contracts at the US Department of Energy (DOE) facilities located at the Hanford Site, near Richland, Washington.

49268 **Thermal contact of joints between different kinds of metals at low temperatures.** Mamiya, T.; Yano, H.; Uchiyama, T.; Inoue, S.; Miura, Y. (Department of Physics, Nagoya University, Chikusa-ku, Nagoya 464, Japan). *Review of Scientific Instruments;* **59**: No. 8, 1428-1430(Aug 1988).

It was found from electrical measurements at 4.2 K that good thermal contact between different kinds of metals can be obtained much more effectively by fastening two pieces with a screw of a large diameter rather than by welding. The thermal conduction of a threaded joint between silver and platinum has been achieved equal to that of copper-to-copper joints.

49269 **Rotating shielded crane system.** Commander, J.C. (to Dept. of Energy, Washington, DC). US Patent 4,746,485. 24 May 1988. Filed date 19 Nov 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A rotating, radiation-shielded crane system is described comprising: a generally cylindrical, radiation-shielding wall, the top of the wall forming a first annular ledge; a second annular ledge integrally attached to the inner surface of the shielding wall; a generally cylindrical ceiling made of radiation shielding material, the ceiling including a flange portion on the top thereof and a body portion, the flange portion associated with the second annular ledge such that the ceiling is supported thereby, the volume inside the wall and the ceiling forming a test cell; a rotatable crane disposed above the ceiling such that the crane is outside of the test cell; removable access means in the ceiling for allowing the crane to access the inside of the test cell from the top of the ceiling; means for sealing the interface between the inner surface of the shielding wall and the ceiling.

4203 Lasers

REFER ALSO TO CITATION(S) 49325, 49361, 50111, 50132

49270 **(AD-A—193438/9/XAB) Electro-optical devices. Annual report, 1 October-30 September, 1984.** Tsang, D.Z.; Williamson, R.C. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 30 Sep 1984. 55p. NTIS, PC A04/MF A01.

GaInAsP/InP buried-heterostructure lasers formed by thermally transported InP have resulted in low threshold, high efficiency, and high device yield. Zinc diffusion was utilized to improve the light-current linearity and reduce the threshold temperature dependence. A technique was developed to calculate the voltage and current distributions in the mass-transported GaInAsP/InP buried-heterostructure lasers. It is valuable for designing lasers for operation without current leakage through the InP pn homojunctions formed in the transported regions. Mass-transported GaInAsP/InP buried-heterostructure lasers with low threshold currents and a linear light output to greater than 13 mW per facet have been obtained. This is achieved by using sufficient p-doping in the cap layer of the starting double-heterostructure wafer. Buried-heterostructure, actively Q-switched diode lasers have been made with threshold currents as low as 14 mA. The lasers operate continuously at room temperature. Full on/off modulation was observed at measurement-limited rates of about 12.6 GHz while modulation was

seen at rates of 13.5 GHz. The InP mass-transport technique was used to improve chemically etched mirrors for GaInAsP/InP buried-heterostructure lasers. Devices with one such mirror and a second cleaved mirror show high device yield, thresholds currents as low as 5 mA, and differential quantum efficiency as high as 33%.

49271 **(AD-A—193446/2/XAB) Electro-optical devices. Annual report, 1 October 1985-30 September 1986.** Tsang, D.Z.; Williamson, R.C. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 30 Sep 1986. 21p. NTIS, PC A03/MF A01.

The small-signal frequency response of small-contact mass-transported buried-heterostructure lasers with minimal parasitic contact pad capacitance was measured. Initial results show that the highest relaxation frequency of 5 GHz is obtained in long lasers with high optical power. GaInAsP/InP buried-heterostructure lasers fabricated on p-InP substrates offer considerable advantages in terms of reduced-series resistance because of the large-area p-contact. A simple formula has been derived from permits an accurate calculation of the spreading resistance in the p-InP.

49272 **(AD-A—193455/3/XAB) Collisional energy transfer in optically pumped far-infrared lasers.** McCormick, R.I.; Everitt, H.O.; De Lucia, F.C.; Skatrud, D.D. (Duke Univ., Durham, NC (USA). Dept. of Physics). Dec 1987. 11p. NTIS, PC A03/MF A01.

Pub. in IEEE Jnl. of Quantum Electronics, Vol. QE-23, No. 12, 2069-2077(Dec 1987).

A numerical simulation of collisional energy transfer in optically pumped far-infrared (OPFIR) lasers is presented along with a discussion of each collisional process and how it affects laser operation. A simulation is required to adequately describe these lasers because of the relatively large number of nonequilibrium states and thermal pools that are significant in the dynamics of their excitation and relaxation. The results of diagnostic studies and theoretical considerations are used to restrict the numbers of degrees of freedom so that a numerically tractable and physically satisfying model results. The resulting simulation accurately characterizes collisional energy transfer in these lasers over a much wider range of physical conditions than is possible with analytic models. These conditions include the very-low pressure regimes most suited to the recovery of fundamental molecular collisional energy transfer parameters. Significantly for OPFIR lasers, it predicts a new operating regime, which has been experimentally verified, that leads to small, tunable CW laser systems.

49273 **(AD-A—193516/2/XAB) Time-resolved study of rotational and vibrational excitation and relaxation in the $^{13}CH_3F$ optically pumped far-infrared laser.** McCormick, R.I.; De Lucia, F.C.; Skatrud, D.D. (Duke Univ., Durham, NC (USA). Dept. of Physics). Dec 1987. 11p. NTIS, PC A03/MF A01.

Pub. in IEEE Jnl. of Quantum Electronics, Vol. QE-23, No. 12, 2060-2068(Dec 1987).

The rotational and vibrational energy-transfer processes of the CH_3F optically pumped far-infrared (OPFIR) laser were studied in a time-resolved experiment. The experiment uses a tunable millimeter and submillimeter spectroscopic technique as a diagnostic probe. Included are observations of the fast Delta J processes that closely connect other J states with K = 3 to the directly pumped J = 5 level, a vibrational swapping mechanism that transfers excitation from K = 3 to other K states, vibrational relaxation due to both wall collisions and molecule-molecule collisions, the nonunity probability of vibrational deactivation in a wall collision, and pump saturation and hole-burning effects due to the CO_2 pump laser. All of these observations are accounted for in the context of a numerical simulation. This results in a complete map of all of the collision-induced rotation/vibration transitions of importance to this basic OPFIR system including quantitative cross sections for the relevant processes.

49274 **(AD-A—193756/4/XAB) Undulator radiation source for spin-polarized photoemission studies of novel magnetic materials. Progress report, December 1987-April 1988.** Bader, S.D.; Shenoy, G.K. (Argonne National Lab., IL (USA). Materials Science and Technology Div.). 15 Apr 1988. 4p. NTIS, PC A02/MF A01.

A soft x-ray undulator is to be based at the vacuum-ultraviolet storage ring at the National Synchrotron Light Source, NSLS. The undulator will be used as a radiation source by a multi-institutional research team to perform the first spin-polarized photoemission experiments in the United States. Issues and challenges associated with advanced magnetic materials and the importance of undulator and free-electron-laser capabilities are highlighted in the presentation.

49275 **(AD-A—193902/4/XAB) Frequency doubling at 1.315 micrometers. Final report, September 1984-August 1985.** Humphreys, R.H.; Johnson, D.E.; Keating, P.; Hager, G.D. (Air Force Weapons Lab., Kirtland AFB, NM (USA)). Feb 1988. 26p. (AFWL-TR—87-54). NTIS, PC A03/MF A01.

Using lithium iodate crystals, second-harmonic generation of chemical oxygen/iodine laser (COIL) light (gamma = 1.315 mircometers) was demonstrated for the first time. Both a photolytic iodine laser and a COIL were used. For the photolytic iodine laser, 320 mW of red output in 40-microsecond pulses was generated in an extracavity configuration at a conversion efficiency of 2.1 x 10^{-5}. With the COIL device, 60 mW of average second harmonic power was observed at an overall conversion efficiency of 1% when the crystal was placed intracavity. In both cases, experimental second-harmonic powers were in good agreement with theoretical values.

49276 **(AD-A—194141/8/XAB) Proposal for free-electron laser driven by the National Bureau of Standards' c-w microtron.** Maruyama, X.K.; Penner, S.; Tang, C.M.; Sprangle, P. (National Bureau of Standards, Washington, DC (USA)). 1987. 4p. NTIS, PC A02/MF A01.

Pub. in Nuclear Instruments and Methods in Physics Research, Vol. A259, 259-262(1987).

A free-electron laser (FEL) driven by the racetrack microtron (RTM) which is under development at the National Bureau of Standards (NBS). The design of the NBS RTM has many exceptional properties: (i) normalized transverse emittance of better than 10 mm mrad, comparable to a storage ring; (ii) axial emittance less than 30-keV deg., much superior to rf linacs; (iii) electron energy tunable from 20 to approximately 200 MeV; (iv) c-w operation; (v) energy stability; (vi) compactness; and (vii) high power-conversion efficiency. The authors propose accelerator upgrades to increase the peak current. It seems possible to obtain peak current larger than 2A, for an average electron beam power of 100 kW. The wavelength of the fundamental radiation from the FEL can span from 0.25 to 10 micrometer, and harmonics will be produced in the UV spectral region. Because of the wavelength range, tunability, high average power, continuous beam, and the ability to generate picosecond pulses, this FEL will be suitable for a wide range of applications.

49277 **(DOE/ER/13275—T1) Gas-loaded free-electron lasers: Final report.** (Stanford Univ., CA (USA)). 1988. Contract FG03-84ER13275. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014652/JAW.

The goal of this research program is to investigate and develop a gas--loaded free--electron laser (GFEL) as a source of tunable, coherent radiation at wavelengths from the near--infrared to the ultraviolet. 20 refs., 2 figs.

49278 **(DOE/ER/13275—T2) [A gas-loaded, free-electron laser]: Final report.** (Stanford Univ., CA (USA)). [1988]. Contract FG03-84ER13275. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88016090/JAW.

Investigate and develop a gas-loaded free-electron laser (GFEL) as a source of tunable coherent radiation at wavelengths from the near-infrared to the ultraviolet. 20 refs; 2 figs.

49279 **(LA-UR—88-2019) Fluid dynamic issues in continuous wave short wavelength chemical lasers.** Mikatarian, R.R.; Jumper, E.J.; Woolhiser, C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 35p. (CONF-880676—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014428/JAW.

From Conference on thermophysics, plasma dynamics and lasers; San Antonio, TX, USA (27 Jun 1988).

This paper addresses fluid dynamic issues of concern in the design and development of Continuous Wave (CW) Short Wavelength Chemical Lasers (SWCLs). Short Wavelength Chemical Laser technology is in its research stage and SWCL concepts are in their evolving mode. Researchers are presently addressing candidate chemical systems and activation concepts. Since these lasers will be flowing systems, it is necessary to discuss both the probable fluid dynamics issues, because of the inherent complexities fluid dynamicist can support this activity. In addition to addressing the SWCL fluid dynamic issues, this paper will review past fluid dynamic activities in high energy lasers and discuss additional research still required. This paper will also address the various levels of fluid dynamic modeling and how these models can be applied in studying the fluid dynamics of Short Wavelength Chemical Lasers. Where it is felt that specific fluid methodologies are not available, but are required in order to conduct specific analyses, they will be defined. 34 refs., 6 figs., 1 tab.

49280 **(LA-UR—88-2136) Recent results from the Los Alamos free-electron laser.** Feldman, D.W.; Warren, R.W.; Carlsten, B.E.; Stein, W.E.; Watson, J.M.; Brau, C.A.; Spalek, G.; Young, L.M.; Lumpkin, A.H.; Bender, S.C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 39p. (CONF-880888—9). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014409/JAW.

From Free electron laser seminar; Beijing, China (11 Aug 1988).

In this paper we review the most recent experimental results of the Los Alamos free-electron laser program. Three major effects will be described: lasing at improved efficiency over that previously attained, electron beam improvement, and energy recovery. An extraction efficiency of 2% was achieved with a wiggler having a 12% wavelength taper. The beam has been improved so that limits to its quality are now caused, not by injector performance, but by wake fields related to the high peak currents achieved. Limits to optical power are set by mirror damage. Experiments are described that demonstrate the successful operation of an energy recovery system. 17 refs., 10 figs., 3 tabs.

49281 **(N—88-23198) Development program for 1.93-micron lasers. Contractor report, 24 September 1986-24 September 1987.** Longeway, P.; Zamerowski, T.; Martinelli, R.; Stolzenberger, R.; Digiuseppe, N. (David Sarnoff Research Center, Princeton, NJ (USA)). May 1988. 26p. (NASA-CR—4148; DSRC—88-CR-1; NAS—1.26:4148). NTIS, PC A03/MF A01.

For the first time lasers operating at 1.93 microns were demonstrated. The lasers were fabricated by Vapor Phase Epitaxial (VPE) growth techniques currently used for the fabrication of high power lasers at 1.3 microns. The structure of these laser diodes consisted of compositionally graded, sulfur-doped InAsP, grown on an InP substrate; a constant-composition n+InAs(0.27)P(0.73) layer, which is the first cladding layer; an In(0.66)Ga(0.34)As layer, which is the active region, and a second InAs(0.27)P(0.73) layer. The devices were oxide-stripe DH lasers (gain-guided only). The best devices had 80 K lasing thresholds in the range of from 80 to 150 mA, and T sub o (below 220 K) in the range of 60 to 90 K. The highest observed temperature of oscillation was 15.5 C. The highest observed power output at 80 K was in the range of 3 to 5 mW. The calculated delta I/delta T was 4.4 A/K. As a part of the materials development, PIN homojunction detectors having the band edge near 1.93 were also fabricated. The best devices (100 micron diameter, mesa structure) exhibited room temperature dark currents in the range of from 20 to 50 nA and had QE at 1.93 microns in the range of 35 to 40 percent. In addition to the device results, the InGaAs-InAsP materials system was extensively investigated and low defect density layers can now be grown allowing for significant device performance improvement.

49282 **(PB—88-205224/XAB) Instabilities and chaos in lasers. Final report.** Glorieux, P. (Lille-1 Univ., 59 - Villeneuve d'Ascq (France). Lab. de Spectroscopie Hertzienne). Sep 1987. 37p. (In French). NTIS, PC E04/MF E04.

The intracavity modulator of a CO_2 laser resonates at 300 kHz. When the loss modulation amplitude exceeds the percent at 300 kHz, the emitted intensity becomes erratic, although the system remains deterministic. Experimental and numerical studies were done of the characteristics of the chaotic behavior, observed both in a laser containing a saturable absorber, and in CO_2 laser discharges.

49283 **(PB—88-213228/XAB) Beam properties of a 3 kw carbon dioxide laser.** Frolov, S.J. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Feb 1988. 74p. (In Swedish). (FOA-C—20704-2.3). NTIS, PC E04/MF A01.

In a series of experiments, the beam properties of a continuous 3 kW fast axial flow CO_2 laser was surveyed. Spectrally, the laser worked steadily in the P_20 transition, independent of warming up period or output power. Within the measurement accuracy, the beam was linearly polarized in a fixed plane, apparently determined by the resonator bending mirrors. With the device warmed up, the beam transverse intensity pattern agreed well with a TEM(00) distribution at power levels up to at least 1.5 kW. The measured beam divergence was 2.2 mrad, in exact agreement with the calculated divergence. Even at low levels, power fluctuations with peak amplitudes between 10 and 20% were observed. From approx. 1.5 kW, these fluctuations increased markedly, and the transverse pattern grew more complicated, possibly indicating a transition to the TEM(01)-mode. The strong temporal fluctuations are presumably typical of fast axial flow lasers and may - primarily unwanted - even be to an advantage in certain materials processing applications.

49284 **(SAND—88-0494C) Resonator design with an intracavity time-varying index gradient.** Neal, D.R.; Sweatt, W.C.; Torczynski, J.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 12p. (CONF-880887—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015259/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

Side-pumped lasers such as flashlamp- or reactor-pumped lasers often have a nonuniform energy deposition in the gain medium, which can establish a significant transverse index gradient. This gradient significantly complicates energy extraction. A normalized resonator analysis method is developed that predicts resonator stability transitions and mode sizes for parabolic index fields. Parameter studies for some practical classes of resonators are presented, along with some design guidelines. Experimental comparison for a long-pulse gas laser shows good agreement with stability transition times. Two resonator-design approaches are presented for increasing the extraction efficiency in the presence of intracavity index gradients. 10 refs., 13 figs.

49285 **(UCRL—95654) An efficient high power microwave source at 35 GHz using an induction linac free electron accelerator.** Clark, J.C.; Orzechowski, T.J.; Yarema, S.M. (Lawrence Livermore National Lab., CA (USA)). Nov 1986. Contract W-7405-ENG-48. 11p. (CONF-861240—19). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014482/JAW.

From 3. national conference on high power microwave technology for defense applications; Albuquerque, NM, USA (1 Dec 1986).

The Electron Laser Facility (ELF) is a free-electron laser (FEL) amplifier operating in the millimeter-wave regime. ELF uses the electron beam produced by the Experimental Test Accelerator (ETA), which is a linear-induction accelerator. We discuss here (1) the experimental results reflecting the high-peak-power output and high-extraction efficiency obtained from an FEL amplifier operated with a tapered wiggler magnetic field and (2) the results of studies of the exponential gain and saturated power obtained from an FEL amplifier with a flat wiggler while we parametrically varied the input power to the amplifier and the beam current into the wiggler.

49286 (UCRL—97723) Maximum voltage gradient, uniformity and brightness of dispenser cathodes. Turner, W.C.; Chen, Y.J.; Green, M.C.; Miram, G.V.; Nordquist, A.L. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 6p. (CONF-880713—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014804/JAW.

From 7. international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

Initial measurements of current uniformity and intrinsic cathode brightness are presented a 5.1 cm diameter osmium alloy coated dispenser cathode. The data are obtained with a planar diode driven with a 35ns Blumlein pulse line. Pepper pot images are observed with a fast phosphor and gated camera. The current density and beamlet divergence angle are uniform within +-10% and a brightness $J = 1.6E10A/m^2rad^2$ is observed at a current density $j=44A/cm^2$. 6 refs., 2 figs., 2 tabs.

49287 120-ps duration pulses by active mode locking of an XeCl laser. Shay, T.M.; Sze, R.C.; Maloney, M.; Figueira, J.F. (Los Alamos National Laboratory, P. O. Box 1663, CLS-5, MS E535, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **64**: No. 7, 3758-3760(1 Oct 1988).

A short actively mode-locked XeCl oscillator has produced 120-ps duration pulses for the first time. The pulses have an energy of 15 μJ and a modulation depth of >95%. The evolution of the pulsewidth during the mode-locked pulse train was also measured.

49288 Demonstration of high-performance silicon microchannel heat exchangers for laser diode array cooling. Mundinger, D.; Beach, R.; Benett, W.; Solarz, R.; Krupke, W.; Staver, R.; Tuckerman, D. (Lawrence Livermore National Laboratory, University of California, P. O. Box 5508, L-487, Livermore, California 94550). *Applied Physics Letters;* **53**: No. 12, 1030-1032(19 Sep 1988).

A heat exchanger package has been demonstrated for semiconductor laser arrays using silicon microstructures with water as the coolant. A thermal impedance of 0.04 °C cm^2/W has been achieved for a single linear bar. This design makes use of efficient, edge-emitting laser diode arrays in a rack and stack architecture combined with a high-performance silicon microchannel structure to allow cw operation. The architecture can be scaled to large areas and we project a thermal impedance of 0.09 °C cm^2/W for close-packed two-dimensional arrays on this device.

49289 Energy balance in laser-irradiated vaporizing droplets. Zardecki, A.; Armstrong, R.L. (Los Alamos National Laboratory, Theoretical Division, Los Alamos, New Mexico 87545). *Applied Optics;* **27**: No. 17, 3690-3695(1 Sep 1988).

The interactions of vaporizing aerosols with a high energy laser beam are analyzed in the diffusive vaporization regime. This is the regime in which diffusive mass transport and conductive energy transport dominate the aerosol—beam interactions. A numerical analysis of the coupled aerosol—beam equations allows us to compute the energy conversion of the incident laser pulse. The plots showing the functional form of the pulse shape and the fractional energy conversion are given to illustrate the interactions for a wide range of pulse energies. A new term describing the droplet radius shrinking in time, similar in form to that recently analyzed by Davies and Brock, is included.

49290 Radiative-hydro modeling and atomic data bases. Nilsen, J. (Lawrence Livermore National Laboratory, Livermore, California 94550). *AIP (American Institute of Physics) Conference Proceedings;* **168**: No. 1, 51-58(1 Aug 1988). (CONF-870919—).

From 6. topical conference on atomic processes in plasmas; Santa Fe, NM, USA (28 Sep 1987).

The methods by which we model high temperature plasmas will be described. The code XRASER is run on the Cray computers to simulate the kinetics, hydrodynamics, and radiation transfer in the high temperature plasma. Certain input is required by XRASER in the form of an atomic data file. The atomic data files are created using a variety of production atomic physics codes such as YODA. YODA will generate detailed energy levels, oscillator strengths, photoionization cross sections, collisional excitation and ionization cross section, and auger rates using relativistic multi-configuration wavefunctions. This information is stored in an atomic data base. The code ADAM reads the atomic data from the data base and fills in the requested number of Rydberg energy levels based on a scaled hydrogenic approximation. ADAM adds the oscillator strengths, photoionization cross sections, and collisional excitation and ionization cross sections to connect the Rydberg levels with each other and also to connect the Rydberg levels with the detailed levels provided by YODA. The output of ADAM is a format which XRASER understands. Using the atomic data file and a generator which specifies the plasma, XRASER is run to determine the time dependent properties of the plasma.

49291 No pain: no gain: The complex art of soft x-ray laser target design and analysis. Rosen, M.D.; London, R.A.; Hagelstein, P.L.; Maxon, M.S.; Eder, D.C.; Whitten, B.L.; Chen, M.H.; Nash, J.K.; Schofield, J.H.; Hazi, A.U.; and others. (Lawrence Livermore National Laboratory, Livermore, CA 94550). *AIP (American Institute of Physics) Conference Proceedings;* **168**: No. 1, 102-114(1 Aug 1988). (CONF-870919—).

From 6. topical conference on atomic processes in plasmas; Santa Fe, NM, USA (28 Sep 1987).

We review our methodologies in the design and analysis of soft x-ray laser experiments. We convolve large scale 2-D hydro code output with detailed atomic data bases in a kinetics code with 1-D or 2-D line transfer. The time and space dependent level population data is then post processed further with a beam transport code, including refraction, to predict actual experimental results. While mysteries do remain, we present many examples that show how this complex modeling procedure is crucial in explaining experimental results.

49292 Recent XRL gain measurements in Ne-like Ge and Cu ions. Lee, T.N.; McLean, E.A.; Elton, R.C. (Naval Research Laboratory, Washington, D.C. 20375). *AIP (American Institute of Physics) Conference Proceedings;* **168**: No. 1, 125-134(1 Aug 1988). (CONF-870919—).

From 6. topical conference on atomic processes in plasmas; Santa Fe, NM, USA (28 Sep 1987).

Soft x-ray lasing on 3p-3s transition lines in Ne-like germanium and copper ions has been observed along the axial direction of an elongated, laser-produced plasma. The measured gain coefficients of J = 0 to 1 and J = 2 to 1 lasing transition lines have comparable values in the present experiment as predicted, in contrast with previous studies. Also, for the first time, gain coefficients have been measured using a thick slab instead of an ultra-thin foil target.

49293 Phase locked RF linac free electron laser. Edlin, G.R.; Jones, R.W.; Perkins, J.F. (to Secretary of the Army, Washington, DC). US Patent 4,748,629. 31 May 1988. Filed date 10 Dec 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A phase locked radio frequency linac free electron laser is described comprising a wiggler laser arrangement for producing a propagating laser beam in the form of micropulses, means for expanding the laser beam to enlarge the propagating beam after it emerges from the laser wiggler, means for dividing the expanded laser beam into a major portion, a minor portion and a substantial output portion, first reflector means for reflecting the major portion about a path to recombining means, second reflector means for reflecting the minor portion about a path to the recombining means. The path for reflecting the minor portion is longer than the path for reflecting the major portion to delay the minor portion in time by at least the spacing between adjacent pulses of the micropulses to cause the micropulses to mix and phase lock, and recompressing means for receiving the beam from the recombining means to reduce the beam and then reintroduce the beam into the wiggler laser.

49294 **Fusion reactor pumped laser.** Jassby, D.L. (to Dept. of Energy, Washington, DC). US Patent 4,746,484. 24 May 1988. Filed date 4 Sep 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A nuclear pumped laser is described comprising: a toroidal fusion reactor, the reactor generating energetic neutrons; an annular gas cell disposed around the outer periphery of the reactor, the cell including an annular reflecting mirror disposed at the bottom of the cell and an annular output window disposed at the top of the cell; a gas lasing medium disposed within the annular cell for generating output laser radiation; neutron reflector material means disposed around the annular cell for reflecting neutrons incident thereon back into the gas cell; neutron moderator material means disposed between the reactor and the gas cell and between the gas cell and the neutron reflector material for moderating the energy of energetic neutrons from the reactor; converting means for converting energy from the moderated neutrons to energy pumping means for pumping the gas lasing medium; and beam compactor means for receiving output laser radiation from the annular output window and generating a single output laser beam therefrom.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 48427, 48488, 48823, 48910, 49853, 49854

49295 **(AD-A—193356/3/XAB) Computational boundary conditions for the incompressible Navier-Stokes equations in channels and pipes. Technical summary report.** Ache, G.A. (Wisconsin Univ., Madison (USA). Center for Mathematical Sciences). Oct 1987. 38p. (CMS-TSR—88-12). NTIS, PC A03/MF A01.

This document derives inflow and outflow boundary conditions for the incompressible Navier-Stokes equations in cylindrical geometries. The purpose of these boundary conditions is to allow computations in a finite domain, that model flow in an unbounded domain, in a way that the accuracy of the finite-difference solution is retained, making the computation more efficient. An approach similar to a previous studies is used to represent the solution asymptotically, far downstream and upstream, as a series expansion that involves eigenvalues and eigenfunctions. These eigensolutions satisfy certain systems of ordinary differential equations. The boundary conditions are represented by a family of differential operators in a way similar to what was done by Bayliss, Gunzberger, and Turkel. To demonstrate the effectiveness of these boundary conditions we applied them in numerical computations of the incompressible Navier-Stokes equations in a channel with a step and in a pipe with a sudden enlargement of the cross section. To numerically solve the Navier-Stokes equations, a second-order, accurate, finite-difference scheme was used, also the boundary operators were approximated using second-order accurate, finite-difference formulas. The numerical results show the effectiveness and the increase accuracy obtained by using the higher-order boundary conditions.

49296 **(AD-A—193777/0/XAB) Accurate, stable, explicit, parabolized navier-stokes solver for high speed flows.** Gielda, T.P.; McRae, D.S. (North Carolina State Univ., Raleigh (USA)). 1986. 14p. NTIS, PC A03/MF A01.

Pub. in Proceedings of AIAA/ASME Fluid Mechanics, Plasma Dynamics and Lasers Conference (4th), 1-12(May 1986).

A stable, accurate, and efficient implementation of MacCormack's explicit algorithm for the Parabolized Navier-Stokes equations is demonstrated. The familiar problem of decoding the conservative axial flux vector is solved, resulting in accurate, smooth dependent variable profiles through the viscous-layer sonic line. Source terms due to transformation of the parabolized governing equations into the computational plane and the equations into the computational plane and the resulting metric differencing have been identified and eliminated through inclusion of appropriate geometric conservation law terms. Test cases computed include two- and three-dimensional supersonic and hypersonic flow at laminar and turbulent Reynolds numbers. The computed results demonstrate very good agreement with experiment and with solutions of the full Navier-Stokes equations. Computational times required for the MacCormack explicit PNS code are approximately equal to those of the existing implicit PNS solvers. The explicit PNS code proved to be sufficiently robust to allow starting the computation from free-stream conditions. In addition, little or no damping is required once the initial starting transients have been reduced.

49297 **(AD-A—194011/3/XAB) Alignment of vorticity and scalar gradient with strain rate in simulated Navier-Stokes turbulence.** Ashurst, W.T.; Kerstein, A.R.; Kerr, R.M.; Gibson, C.H. (National Center for Atmospheric Research, Boulder, CO (USA)). Aug 1987. 13p. NTIS, PC A03/MF A01.

Pub. in Physics of Fluids, Vol. 30, No. 8, 2343-2353(Aug 1987).

The alignment between vorticity and eigenvectors of the strain-rate tensor in numerical solutions of Navier-Stokes turbulence is studied. Solutions for isotropic flow and homogeneous shear flow from pseudospectral calculations using 128(cubed) grid points were examined. The propensity for vorticity alignment with a positive intermediate strain is a consequence of angular momentum conservation, as shown by a restricted Euler model of the coupling between strain and vorticity. Probability distributions for intermediate strain, conditioned on total strain, change from a symmetric triangular form at small strain to an asymmetric one for large strain. The most-probable value of the asymmetric distribution gives strains in the ratios of 3:1 - 4. The evolution of the distribution from a symmetric to an asymmetric form as the strain magnitude increases is essentially the same in both flows, indicating a generic structure of intense turbulence. The alignment between the gradient of a passive scalar and eigenvectors of the strain-rate tensor for Prandtl numbers of 0.1, 0.2, 0.4, and 1.0 is studied. There is an increased probability for the scalar gradient to align in the most compressive-strain direction, and the average gradient is larger when it is pointing in that direction.

49298 (CONF-8510495—, pp 3-27) **Self-excited vibrations in pipe bundle heat exchangers.** Hesse, F. 1986. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770381/JAW.

From Colloquium of the Special Research Group 211 on time-dependent processes and recognising damage in components of thermal plants of Hannover University; Hannover, F.R. Germany (3 Oct 1985).

The vibration behaviour of fluidically coupled pipes is at the heart of this lecture. The movement of pipes due to simple flow around them, with regard to various effects such as separation of eddies, galloping etc., is examined. The experimental plant for examining the fluid elastic coupling of fluids at rest is introduced. The first results of experiments with water and with liquids of higher viscosity are also discussed. (HAG).

49299 (CONF-8510495—, pp 29-40) **Investigations of vibration behaviour of a single tube excited by inside flow.** Heyn, A. 1986. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770381/JAW.

From Colloquium of the Special Research Group 211 on time-dependent processes and recognising damage in components of thermal plants of Hannover University; Hannover, F.R. Germany (3 Oct 1985).

This article is concerned with the exciting mechanism of tube vibration in heat exchangers. The resonance area of parameter excitation is first examined. The test rig is also explained and the first results of tests are introduced and discussed. (HAG).

49300 (CONF-8510495—, pp 41-65) **On the use of experimental data in fluid elastic calculations for actual cross-flow heat exchangers.** Bardowicks, H. 1986. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770381/JAW.

From Colloquium of the Special Research Group 211 on time-dependent processes and recognising damage in components of thermal plants of Hannover University; Hannover, F.R. Germany (3 Oct 1985).

The author is concerned with fluid elastic vibrations, which can be produced by flow forces. Initially, the parameters of fluid elastic vibrations in tube bundle heat exchangers are described. Apart from the experimental methods, the results of investigations of free and forced vibrations are introduced. Finally, the measure-

ment and evaluation of pressure distributions on tube surfaces varying with time are explained. (HAG).

49301 **(CONF-8804100—5) Absorption enhancement research and related diagnostics.** Perez-Blanco, H.; Patterson, M.R.; Bostick, D.T.; Klatt, L.N. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 13p. NTIS, PC A03. Order Number DE88013241/JAW.

From 2. DOE/ORNL heat pump conference: research and development on the heat pump for space conditioning applications; Washington, DC, USA (17 Apr 1988).

An understanding of the absorption process and of the techniques that can be employed for its enhancement is an important step in the development of the technology. This paper reports on ongoing experimental efforts toward developing that understanding, as well as on related research already completed in the area. The experimental apparatus under construction is described, with the techniques to be employed. Absorber performance data analysis requires accurate property values in the form of computer routines. The routines developed to date are described here. A brief status report of the development of a fiber optics instrument, which will monitor concentration at different absorber locations, is also included. 19 refs., 7 figs., 3 tabs.

49302 **(DOE/ER/13597—T1) Experimental and theoretical studies of vertical annular liquid jets: Technical report No. 2.** Chigier, N.; Ramos, J.I.; Kihm, K.D. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Mechanical Engineering). May 1988. Contract FG02-86ER13597. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012971/JAW.

The objectives of this study are to determine the stability, dynamics, and convergence of vertical annular liquid jets as a function of the initial radius, sheet thickness, and velocity. The influence of variation of Froude, Reynolds, and Weber numbers and geometry on convergence and stability are examined. An implicit finite-difference scheme is developed for solution of the stead-state and time-dependent axisymmetric Navier--Stokes equations. In collaboration with Westinghouse, a cylindrical film chemical reactor will be designed for control of reactions such as reduction of zirconium. Annular liquid curtains have been formed with an initial curtain radius of 50 mm and initial sheet thicknesses of 0.5 and 1.0 mm. Three Froude numbers have been studied: 1.27, 4.27, and 8.87 with variation of the liquid flow rate. Pressure within the curtains has been varied progressively from 0 to 3 Pa. Several flow regimes were found: a) non-pressurized, b) pressurized, c) oscillating, and d) punctured. Curtain shape and convergence length were determined for each condition by photography. Axial mean velocity in the liquid curtain was measured by Laser Doppler Anemometry along the length of the curtain. The variation of liquid film thickness with axial distance was determined. 12 figs., 3 tabs.

49303 **(DOE/ER/13800—T1) The impact of separated flow on heat and mass transfer: Progress report, September 1, 1987 through April 30, 1988.** Goldstein, R.J.; Jabbari, M.Y. (Minnesota Univ., Minneapolis (USA)). 1988. Contract FG02-87ER13800. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014653/JAW.

The purpose of these studies is to increase our understanding of the key parameters and the fundamental mechanisms in flow and heat transfer under separated flow conditions. Detailed mass transfer studies from a circular cylinder near its base, and from its base plate, have been carried out and reported. In some applications the protruding cylinder may not be circular; therefore, non-symmetrical horseshoe vortices may set up rendering an asymmetrical mass transfer distribution. To learn about this situation a study was initiated to measure the effect of separation on mass transfer from a square cylinder projecting out of a plate. The early results indicate that in the separated region formed ahead of the cylinder vortices are generated which, similar to the case of circular cylinder, cause increased mass transfer both from the cylinder and from the end plate. Sample contours of constant mass transfer coefficient on the end plate and around the cylinder are shown on Figure 1. The angle between the incoming flow and the normal to the upstream facing surface of the cylinder is 20 degrees. Note that near the corners of the cylinder the vortices produce a very high mass transfer coefficient. From this study we conclude that energy separation in the jet will cause significant variation of the recovery temperature near the impingement points when L/D is small, that adiabatic effectiveness is independent of the jet and ambient temperature difference if the effectiveness is defined using recovery temperatures, and that the heat transfer coefficient also is independent of the entrainment if defined on the basis of the difference between the heated and adiabatic wall temperatures. 7 figs.

49304 **(DOE/ER/13820—T1) Periodically structured multiphase flows and hydrodynamic instabilities in narrow capillaries: Progress report.** Maldarelli, C. (City Univ. of New York, NY (USA). Research Foundation). Aug 1988. Contract FG02-88ER13820. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015608/JAW.

The research program focuses on two multiphase flow regimes in straight circular tubes. The first is the two-phase motion of a train of gas bubbles or liquid segments moving in a continuous liquid which wets the tube wall. The second is the the three-phase motion of an alternating train of gas bubbles or nonwetting liquid segments moving over an annular wetting film of liquid immiscible with the segment fluid. Each of these flows is assumed to be at low Reynolds and capillary numbers. Both experimental and theoretical efforts are involved. 8 figs.

49305 **(EGG-M—88219) Discrete modeling considerations in multiphase fluid dynamics.** Ransom, V.H.; Ramshaw, J.D. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 11p. (CONF-880792—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015188/JAW.

From Japan-U.S. seminar on two-phase flow dynamics; Kyoto, Japan (15 Jul 1988).

The modeling of multiphase flows play a fundamental role in light water reactor safety. The main ingredients in our discrete modeling Weltanschauung are the following considerations: (1) Any physical model must be cast into discrete form for a digital computer. (2) The usual approach of formulating models in differential form and then discretizing them is potentially hazardous. It may be preferable to formulate the model in discrete terms from the outset. (3) Computer time and storage constraints limit the resolution that can be employed in practical calculations. These limits effectively define the physical phenomena, length scales, and time scales which cannot be directly represented in the calculation and therefore must be modeled. This information should be injected into the model formulation process at an early stage. (4) Practical resolution limits are generally so coarse that traditional convergence and truncation-error analyses become irrelevant. (5) A discrete model constitutes a reduced description of a physical system, from which fine-scale details are eliminated. This elimination creates a statistical closure problem. Methods from statistical physics may therefore be useful in the formulation of discrete models. In the present paper we elaborate on these themes and illustrate them with simple examples. 48 refs.

49306 **(KFK—4373) Dynamical behaviour of natural convection in closed loops.** Ehrhard, P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Apr 1988. 133p. (In German). NTIS (US Sales Only), PC A07/MF A01; GPO Dep. Order Number DE88754604/JAW.

A one dimensional model is presented together with experiments, which describe the natural convective flow in closed loops heated at the bottom and cooled in the upper semicircle. Starting from a single loop, mechanical and thermal coupling with a second loop is discussed. The experiments and the theoretical model both concurrently demonstrate that the investigated natural convection is clearly influenced by non-linear effects. Beside the variety of stable steady flows there are extensive subcritical ranges of convective flow. In these parameter ranges subcritical instabilities of the steady state flow could occur in the presence of finite amplitude disturbances. However, the supercritical, global unstable range is characterized by chaotic histories of the variables of state. Nonsymmetric heating generates an imperfect bifurcation out of the steady solution with zero velocity in the loop. This effect stabilizes

the flow in the preferred direction. The flow in the opposite direction only remains stable in a small isolated interval of the heating parameter. Furthermore the calculations with the model equations demonstrate that a stable periodic behaviour of the flow is possible in a small parameter window. However, it has not been possible to verify this particular effect in the experiments conducted to date.

49307 **(NP—8700380) Development of fast calculation methods on the state properties of water for the design and optimization of energy-converting plants.** Schiebener, P.; Straub, J. (Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl A fuer Thermodynamik). 1988. 27p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770380/JAW.

During the phases of layout and optimization of cycle processes in power plants the equations of state are called 20000 to 80000 times in order to calculate the thermodynamic properties at each part load point. In this work we tried to shorten this part of the calculation time by using approximation techniques which take over the task of calculating the properties within a given accuracy. We investigated different numerical methods such as polynomial and spline interpolations or short range equations which are to be used in very limited parts of a whole surface or combinations of the methods mentioned above. The time savings of the methods are depending on the property of interest between a factor of 5 to 100 in comparison with the equation of state (IFC67) which is used nowadays under international agreement for calculations where water is involved, warranty procedures and more. Another aspect of using short range equations is the field of programming controlling chips or realtime controlling in special parts. The principle of this approximation system is suitable to be transferred to other fields of application.

49308 **(NP—8770383) Flexible, oxygen-tight plastic heat transfer system.** Hanisch, F. (Kabelmetal Electro G.m.b.H., Hannover (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1987. 104p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88770383/JAW.

District heat is commonly supplied via thermally insulated metal tubes. The report presents a heat transfer system with plastic tubes, including their development, production and testing. The inner tube containing the fluid, the jointing technology, the thermal insulation, and the outer shell are described. The overall system is investigated, and the concept of a new service water system is discussed. (HAG).

49309 **(PB—88-218334/XAB) Measurement and prediction of saturation-pressure relationships in three-phase porous media systems.** Lenhard, R.J.; Parker, J.C. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). 1987. 20p. NTIS, PC A03/MF A01.

Pub. in Jnl. of Contaminant Hydrology, Vol. 1, No. 4, 407-424(Jun 1987).

Scaled multiphase versions of the Brooks-Corey and van Genuchten retention functions were used to describe saturation-capillary pressure curves measured in air-water, air-organic liquid and organic liquid-water systems in a sandy porous medium for four organic liquids during monotonic wetting phase drainage. Scaling was achieved by a linear transformation of capillary pressures using scaling coefficients which are shown to be closely predicted by ratios of measured interfacial tensions, providing that the latter are measured on fluids having contacted the porous media system. The multiphase version for the van Genuchten function described the experimental data with slightly greater precision than the Brooks-Corey function for all four organic liquid systems. A technique is introduced to ensure that when two-phase saturation-capillary pressure measurements are used to predict fluid behavior in three-phase systems, the estimated parameters imply an invariate pore geometry pertinent to the description of a rigid porous medium.

49310 **(SAND—87-2496C) A finite element formulation for incompressible, conjugate, viscous/porous flow problems.** Gartling, D.K. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 8p. (CONF-880936—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88007113/JAW.

From 1. international conference on computational mathematics in flow analysis; Okayama, Japan (5 Sep 1988).

In previous work, the Brinkman equation was used to describe the flow in a porous region. The objective of the present study was to develop a general method for solving conjugate fluid and porous flow problems using a finite element method. In pursuing this goal several combinations of porous flow equations and interface conditions were examined and compared. 12 refs., 3 figs.

49311 **(SFB—210/E-21) Laser supported particle detecting system in comparison to the Coulter Counter and the Hiac PA 720.** Doell, B.; Hoffmann, E.; Lawler, D. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Sonderforschungsbereich 210 Stroemungsmechanische Bemessungsgrundlagen fuer Bauwerke). Aug 1986. 20p. Karlsruhe Univ. (T.H.) (Germany, F.R.). Sonderforschungsbereich 210 Stroemungsmechanische Bemessungsgrundlagen fuer Bauwerke.

The purpose of these investigations is to demonstrate the ability of a standard Laser-Doppler-Velocity-Equipment (LDV) to get not only information about local velocities and their fluctuations but also about local size and concentration of particles suspended in flowing medias. Such information are of main interest not only for fundamental research but also for particle (size) applications. Particle detecting systems are commonly used in various fields of interest, for example, in indicating the particular pollution of air, water or chemical agents. In water technologies, particle-analysing systems are especially applied to quantify the efficiency of processing units (e.g. filtration or sedimentation steps). Starting with the method of Chigier and co-workers (1979) some experiments were run to get similar information in fluid flow carrying particles. To test the quality of the laser results, simultaneous measurements were performed using standard particle analysing systems. The systems were the Coulter Counter and the Hiac PA 720. A detailed comparison of both was the object of an extra investigation (Lawler, 1984).

4205 Materials Testing

REFER ALSO TO CITATION(S) 48488, 48598, 48998, 49108, 49329, 49463, 49464

49312 **(AD-A—193700/2/XAB) Comparison of 2-D Fourier and spatial techniques for removing noise in real-time x-ray radiography. Final report, 1 October 1986-31 December 1987.** Carson, D.L. (Arnold Engineering Development Center, Tullahoma, TN (USA)). Apr 1988. 44p. (AEDC-TR—87-37). NTIS, PC A03/MF A01.

When x-raying rocket-propulsion systems during testing, periodic noise can corrupt the overall quality of an x-ray image. This periodic noise results from vibrations caused by the rocket firing and/or from the pulsing of the x-ray source. A method of removing band-limited noise for enhancement of real-time radiographic images of propulsion systems under test conditions is, therefore, desired to improve data analysis. This investigation compares the Fourier and spatial techniques relative to their ability to eliminate random and periodic noise. Fast Fourier transform (FFT) techniques are discussed with respect to efficiency and ease of implementation. Methods of removing low- and high-frequency and band-limited noise are demonstrated using both Fourier and spatial techniques. The RADIX-2 method of performing an FFT was selected for this investigation because of ease of implementation and reasonable computation time for a data-transfer processor. The Fourier-domain techniques were found to be better suited for removing band-limited periodic noise because extensive spatial filtering by means of frame averaging destroys the time resolution of the image.

49313 (CONF-8510495—, pp 93-126) **Determining the course of cracks in three-dimensional structures.** Hartmann, D. 1986. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770381/JAW.

From Colloquium of the Special Research Group 211 on time-dependent processes and recognising damage in components of thermal plants of Hannover University; Hannover, F.R. Germany (3 Oct 1985).

The author is concerned with a process of measurement which makes it possible to recognise the configuration and growth of cracks. First, the DC potential method and the associated measuring technique are introduced. Then an approximation process for estimating the crack front, based on calibration measurements is introduced. Then the possibilities of the numerical treatment of the problem are stated in detail. A first three-dimensional calculation should show possibilities and existing limits of the method, in comparison with measurements. (HAG).

49314 (CONF-8510495—, pp 127-161) **Recognising damage using double pulse holography.** Hajduk, M. 1986. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770381/JAW.

From Colloquium of the Special Research Group 211 on time-dependent processes and recognising damage in components of thermal plants of Hannover University; Hannover, F.R. Germany (3 Oct 1985).

The author tries to use double pulse holography in nondestructive material testing. A process of measurement is explained, where holographic interferometry with double pulse lasers is to the fore. The experimental rig is also described. Results of measurements are discussed, which were obtained by loads similar to those in operation, such as internal pressure loads and pipe wall deformation, which are due to various causes. (HAG).

49315 **(EPRI-NP—5948) Evaluation of the commercial machine works BorSonic System: Final report.** Nottingham, L.D.; Zayicek, P.A. (Electric Power Research Inst., Palo Alto, CA (USA); Jones (J.A.) Construction Co., Charlotte, NC (USA)). Aug 1988. 69p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015209/JAW.

An evaluation of the performance of Commercial Machine Works' BorSonic{trademark} rotor inspection system was conducted by the EPRI NDE Center. At the time of this evaluation, the BorSonic{trademark} rotor inspection system was owned and operated by Commercial Machine Works. Currently, the BorSonic{trademark} system, including the technology, hardware, and patent rights is owned by Westinghouse Electric Corporation. The tests reported herein were conducted by CMW personnel. Rotor bore blocks containing surface-connected fatigue cracks, embedded glass beads, and embedded radial-axial oriented disks were used in the evaluation. Data were collected during twenty-five independent scans through the blocks. The evaluation consisted of statistical characterization of the detection capabilities, flaw sizing, and locating accuracy, and repeatability of the inspection system. The results of the evaluation and comparisons to other systems evaluated earlier are given in this report. 3 refs., 23 figs., 11 tabs.

49316 **(GKSS—88/E/12) Resolution functions and unsharpness in neutron radiography.** Wrobel, M.; Greim, L. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). 1988. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754643/JAW.

Several resolution functions are analysed for description of the unsharpness of knife-edge images. The comparisons are done regarding the definition of unsharpness by Klasens resp. by Morgan. The suitability of a resolution function is assessed according to the goodness of the data fit to the measured densities. The investigations are applied to Dy transfer method, track etch technique and Gd direct method, in each case distinguishing between inherent and geometrical unsharpness. (orig.) With 14 figs., 7 tabs.

49317 (INIS-BR—1147-Vol.2, pp 101-108) **Numerical analysis of reinforced concrete beams under combined loadings.** Bairrao, R. (Portugal). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

It is important, for safety reasons, to determine the actual behaviour and to estimate the features required for reinforced concrete structures in nuclear reactors, subjected to accidental loading such as impacts or earthquakes. Moreover it is preferable for economic reasons to work out global laws with a computer programme using global concepts. Such methods have already been proposed for elasto-plastic materials and for loadings which are predominantly bending loads with a relatively weak normal force component. This paper proposes an extension of these models to include any value of the normal force and considering non-simplified behaviour laws for concrete and steels. The formulation is of elastic-damage-plastic type.

49318 (INIS-BR—1147-Vol.2, pp 161-170) **Neutron radiography in the IEA-R1 reactor.** Pugliesi, R.; Moraes, M.A.P.V. de; Yamazaki, I.M.; Acosta, C.F. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Neutronradiography of several materials have been obtained at the IEA-R1 Nuclear Research Reactor (IPEN-CNEN/SP), by means of two conversion techniques: a) (n,{alpha}) at the beamhole n/sup 0/3 where a collimated thermal neutron beam, exposure area 4 cm x 8 cm and flux at the sample 10/sup 5/ n/s/cm/sup 2/ is obtained. The film used was the CN-85 cellulose nitrate coated with lithium tetraborate (conversor). The time irradiation of the film was 15 minutes and in following was etched during 30 minutes in a NaOH(10W) aqueous solution at a constant temperature of 60/sup 0/C; b) (n,{gamma}) by using an experimental arrangement installed in the botton of the pool of the reactor. The flux of the collimated neutron beam is 10/sup 5/ n/s/cm/sup 2/ at the sample and the conversion is made by means of a dysprozium sheet. The film used was the kodak T-5. The irradiation and the transfering time was 2 hours and 20 hours respectively, and the film used was the Kodak T-5.

49319 (INIS-BR—1147-Vol.2, pp 181-189) **Neutronradiographic tests with the Argonaut reactor of Instituto de Engenharia Nuclear (IEN-CNEN).** Silva, J.J.G. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Some experimental results obtained with the utilization of the Argonaut Nuclear Reactor of Instituto de Engenharia Nuclear, as a thermal neutron source, for study and application of neutronradiography as a technic for non destructive tests in materials are presented.

49320 **(INIS-BR—1160) Radiographic testing in concrete structures.** Oliveira, D. de; Almeida, L.C. de. (Associacao Brasileira de Ensaios Nao Destrutivos, Sao Paulo). 1987. 42p. (In Portuguese). (CONF-8708271—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703869/JAW.

From 7. national seminar of non destructive testing; Rio de Janeiro, Brazil (31 Aug 1987).

The radiographic testing done in concrete structures is used to analyse the homogeneity, position and corrosion of armatures and to detect discontinuity in the concrete such as: gaps, cracks and segregations. This work develops a Image quality Indicator (IQI) with an adequated sensibility to detect discontinuites based on BS4408 norm. (E.G.).

49321 **(INIS-mf—11298) Evaluation of opaque glasses by the radiography technique.** Tugrul, B.; Sungur, F.; Atik, S. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy). 1986. 10p. (In Turkish). (CONF-8610433—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703916/JAW.

From Industrial cooperation in the field of nuclear technology; Istanbul, Turkey (15 Oct 1986).

Opaque glasses can be inspected by the radiography technique because of the metal-oxide contents in them as opaqueness or colored materials. In this study, radiographic exposure parameters for the applications on the opaque glasses are defined and some examples are given with ancient samples. Evaluation can be realized for moding and glass base structure non-destructively.

49322 **(INIS-mf—11299) Usage of radiography techniques for restoration of Cizre Mardin Ulucami door.** Tugrul, B.; Sungur, F.; Gorkem, A.; Olcer, N. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy). 1986. 13p. (In Turkish). (CONF-8605344—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703917/JAW.

From 8. excavation research and archaeometry symposium; Ankara, Turkey (26 May 1986).

In this study, one of the two sections of Cizre-Mardin Ulucami door is investigated by x-ray radiography technique whether it has some patterns similar to those which were discovered during the restoration of the first section of the door. Some painted and traced parts have been fixed and torn down, cleared and investigated. In the study, many pieces of the first part of the door including the second door have been investigated by x-ray radiography technique and have been evaluated. Furthermore, neutrography has been applied on some painted parts for the investigation of traces of painting.

49323 **(PB—88-205158/XAB) Optimal non-destructive defect inspection of airplane turbine ceramic parts. Final report.** Dussoulier, A. (Centre de Documentation de l'Armement (CEDOCAR), 75 - Paris (France). Direction des Recherches, Etudes et Techniques). Dec 1987. 64p. (In French). NTIS, PC E04/MF E04.

The report sums up previous research on nondestructive defect-inspection techniques applied to thermomechanical ceramics and gives the latest developments on those methods selected as most sensitive and most easily adapted for industrial use. Results are discussed for five major techniques: conventional x-ray photography, micro-focus x-ray photography, immersion ultrasound, fluorescent peneration studies, and acoustic microscopy. Combined use of fluorescent-dye studies and acoustic microscopy gives the best results for detection of surface flaws (cracks). X-ray photography and immersion ultrasound techniques complement each other perfectly for detection of internal defects (cavities or inclusions).

49324 **(UCRL—97638) Mechanical properties of first-year sea ice at intermediate strain rates.** Blair, S.C. (Lawrence Livermore National Lab., CA (USA)). 20 Nov 1987. Contract W-7405-ENG-48. 10p. (CONF-880892—1). NTIS, PC A02/MF A01. Order Number DE88013810/JAW.

From 9. international conference on port and ocean engineering under arctic conditions; Fairbanks, AK, USA (16 Aug 1988).

Detailed knowledge of the mechanical behavior of saline ice at elevated confining pressure and at intermediate strain rates is essential input to the design of Arctic ports, ice-bound oil platforms, ice breakers, and other structures and equipment engineered to operate under Arctic conditions. A series of laboratory tests has been conducted to determine both the compressive and tensile strengths of saline ice at intermediate strain rates. Data are reported for samples oriented in directions perpendicular and parallel to a sheet of first-year sea ice. Most of the samples were tested at a temperature of {minus}10{degree}C. Results show a decrease in uniaxial and confined compressive strengths as strain rate was raised from 10/ sup {minus}2//s to 0.5/s. Tensile strength, determined from Brazil tests, also decreased with increasing strain rate. The pressure/ volume response of samples taken parallel and normal to the plane of an ice sheet is also reported. Samples taken normal to the plane of the ice sheet generally had higher compressive strength than samples taken in the plane of the ice sheet. 15 refs., 10 figs., 5 tabs.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 49086, 49094, 49095, 49182, 49229, 49260, 49456, 49457, 50150, 50209, 50218, 50219, 50290

49325 **(AD-A—193445/4/XAB) Electro-optical devices. Annual report, 1 October-30 September, 1985.** Tsang, D.Z.; Williamson, R.C. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 30 Sep 1985. 55p. NTIS, PC A04/ MF A01.

The frequency response of an optical guided-wave GaAs interferometer was measured. The bandwidth of the interferometer biased at a null point was 2.2 GHz, limited by parasites. A small-signal bandwidth of approx 3 GHz can be inferred from this measurement for the case where the interferometer is biased to a linear operating point. This is the highest bandwidth yet reported for a guided-wave GaAs modulator. A surface-emitting GaInAsP/InP laser was developed in which a monolithically integrated parabolic mirror is used to up-deflect the output of a buried-heterostructure laser. A threshold current as low as 12 mA and a differential quantum efficiency as high as 46% were obtained. GaInAsP/InP distributed feedback lasers were fabricated with a simple new design in which the grating is etched into the top of a mass-transported buried heterostructure. Single-frequency operation with side modes lower than -32 dB and threshold currents as low as 16 mA was achieved. Single-mode InP p+-n--n+ slab-coupled rib waveguides capable of phase modulating, TE-polarized, 1.3-micrometer radiation were fabricated. These guides should prove useful in the fabrication of two-guide coupler switches and interferometric modulators.

49326 **(AD-A—193799/4/XAB) RLE (Research Laboratory of Electronics) Progress Report Number 129. Report for January-December 1986.** Allen, J.; Kleppner, D. (Massachusetts Inst. of Tech., Cambridge (USA). Research Lab. of Electronics). Jan 1987. 295p. NTIS, PC A13/MF A01.

This is report No. 129 in a series of progress reports issued by the Research Laboratory of Electronics at MIT. The report covers the period January 1 through December 31, 1986 and contains a statement of research objectives, summary of research efforts and lists of funding sources and project staff for each research group within RLE. There are indexes of funding sources and research project staff, and extensive bibliography, and a listing of RLE personnel at the back of the book.

49327 **(BDX—613-3971) Characterization of 4/3 technology large-scale integrated circuit on polysilicon processes: Topical report.** Daskalos, E.C.; Sobering, J.M. (Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.). Aug 1988. Contract AC04-76DP00613. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015572/JAW.

The major variables affecting the polysilicon process are discussed and evaluated. A process was developed to achieve a manufacturable process.

49328 **(DOE/ID/12726—T1) Advanced moisture sensor research and development: Quarterly progress report, SwRI Project 15-2236.** Nicholls, C. (Southwest Research Inst., San Antonio, TX (USA)). 30 Jul 1988. Contract FC07-88ID12726. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015257/JAW.

During the first quarter of this program we have been addressing the objectives of Task 1 which are to develop a moisture sensor based on the proposed nuclear magnetic resonance (NMR) concept and to investigate feasibility. This task is divided into four subtasks covering: a literature search of existing sensors, the definition of processes for which a NMR sensor is suitable, the definition of a development plan and the selection of an industrial collaborator. The collaborator would help in defining the sensor specifications and would ultimately provide a field site at which tests of a fullscale version of the sensor could be tested. 27 refs.

49329 (EGG—10282-2196) Transmission bandwidth improvement using in-fiber Raman amplification. Lin, Chen-Huei; Nelson, Melvin A. (EG and G, Inc., Goleta, CA (USA). Santa Barbara Operations). 1988. Contract AC08-83NV10282. 10p. (S—353-TP; CONF-871161—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014955/JAW.

From International symposium on the technologies for optoelectronics; Cannes, France (16 Nov 1987).

The objective of the in-fiber optical amplification work is to improve the recordability of fast, weak analog diagnostic signals by increasing their intensity. Linear amplification is achieved using the backward stimulated Raman scattering process in a fiber lightguide data link. Feasibility of this technique was experimentally demonstrated and reported last year. Further studies and investigations carried out recently have been aimed at development of a practical multichannel in-fiber amplification technique that will enable acquisition of weak single-transient pulses transmitted over kilometer-length data links. We report here the results of this work, including an interesting observation of enhanced bandwidth in the amplified, versus the unamplified, received signal. 1 ref., 5 figs.

49330 (EGG-EE—7941) Complex impedance and spectral monitoring of power supplies. Chick, D.R. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1988. Contract AC07-76ID01570. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88015096/JAW.

This report investigates the feasibility of using the (Hewlett-Packard) HP4192A Low Frequency Impedance Analyzer and the HP3561A Spectrum Analyzer to detect deteriorating or defective electrical components in three models of power supplies. The tests using these instruments are intended to be done during routine maintenance with the power supplies out of service. The desire is to detect deterioration of components and predict their failure so that the components can be replaced during normal maintenance and prevent failure and unscheduled maintenance of a power supply.

49331 (LA—9956-MS-Pt.2) Losses in magnetic flux compression generators: Part 2, Radiation losses. Fowler, C.M. (Los Alamos National Lab., NM (USA)). Jun 1988. Contract W-7405-ENG-36. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015046/JAW.

This is the second monograph devoted to the analysis of flux losses in explosive driven magnetic flux compression generators. In the first monograph, flux losses from magnetic field penetration into conductor walls was studied by conventional diffusion theory. In the present report flux loss by radiation from the outer conductor walls is treated. Flux leakage rates through walls of finite thickness are first obtained by diffusion theory. It is shown, for normal wall thicknesses, that flux leakage is determined essentially by the wall conductance, defined as the product of wall thickness and wall conductivity. This remains true when the wall thickness is reduced to zero at unchanged conductance. In this case the wall is said to be coalesced. Solutions for a cavity bounded by a perfect conductor on one side and a coalesced wall on the other are then obtained using the complete Maxwell wave equations in both the cavity and free space beyond the coalesced wall. Several anomalies, noted earlier, that arise from diffusion analysis are resolved by the wave treatment. Conditions for the validity of the diffusion treatment are noted, and an expression is obtained within the framework of diffusion theory for energy radiated into space from the cavity walls. The free space wave equations are solved by using the method of characteristics in both the cavity and free space regions. An extension of the characteristic method to situations where the constitutive relations are non-linear is outlined in an appendix. For a special class of these relations, Riemann-like invariants are determined explicitly and used to solve a particular example.

49332 (LBL—25443) Tunneling junctions and the field effect. Kresin, V.Z. (Lawrence Berkeley Lab., CA (USA)). Aug 1987. Contract AC03-76SF00098. 3p. (CONF-870880—1). NTIS, PC A02. Order Number DE88013707/JAW.

From International superconductivity electronics conference; Tokyo, Japan (28 Aug 1987).

Tunneling junctions containing a semiconductor film are studied. The key role is played by the proximity effect. A particularly interesting situation arises in the presence of a high T/sub c/ semiconductor. Its presence increases the sharpness of the field effect. The properties of the system Sc-S-N-S are discussed.

49333 (PNL—6592) Quantitative Luminescence Imaging System description and user's manual. Stahl, K.A.; Batishko, C.R. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015604/JAW.

A Quantitative Luminescence Imaging System (QLIS) was designed and constructed. The system was developed for use in imaging and quantitative analysis of very low light level chemiluminescent phenomena. The luminescent reactions are imaged via microchannel plate image intensifier coupled to a newvicon video camera. The video record of the reaction can be stored on video tape or digitally captured by an image processing system which is integral to a host computer controller. Since the particular experimental conditions for which the QLIS was designed necessitate that the chemiluminescent reaction take place in an rf flux within a waveguide, the system includes a coherent fiber optic image transfer system which allows the video hardware to be mounted externally to the rf waveguide.

49334 (SAND—88-0452C) Image restoration via iterative improvement of the Wiener filter. Jakowatz, C.V. Jr.; Eichel, P.H.; Ghiglia, D.C. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-880887—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014245/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

The Wiener filter has often been employed as a means for solving the signal/image restoration problem. Unfortunately, the information that is required as input for the realization of this filter is, in many practical situations, not available. In particular, when only one degraded, noisy observation of the signal is presented as data, the spectral density function for the signal to be recovered will generally not be known. A typical "fix" to this dilemma has been to assume that the ratio of noise to signal spectral densities is constant with frequency. The value of this constant that makes the best reconstruction is then determined via trial-and-error by a human. In this paper we present an alternative to this over-simplified version of the Wiener filter (K-filter). Specifically, we demonstrate that an estimate of the signal spectral density can be made via an iterative procedure from the data. This results in reconstructions that are generally superior to any output that the simplified Wiener filter can provide. We show simulated results for the case of one-dimensional degradations of image data.

49335 (SAND—88-1004C) Effects of composition and age hardening on precious metal electrical contacts. Pope, L.E.; Peebles, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 20p. (CONF-880946—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88008791/JAW.

From 34. annual IEEE Holm conference on electrical contacts; San Francisco, CA, USA (26 Sep 1988).

Precious metal alloys are commonly used for wiper electrical contacts in electromechanical devices which operate in dry and inert atmospheres. A pin-on-plate experimental configuration has been used to evaluate two different palladium alloy pins (ASTM B540 and ASTM B563) sliding on a gold alloy plate (ASTM B541) age hardened at two temperatures. For all combinations of test conditions except the higher palladium content alloy (ASTM B563), two stages of wear were observed: (1) a prow of Au alloy was formed on the palladium alloy pin and (2) work hardening and roughening of the wear track occurred with transfer and back-transfer of Au alloy material. With the higher palladium alloy pin (ASTM B563) a friction polymer was formed for laboratory air testing. The prow formed on the pin was a mechanical mixture of gold alloy plate and palladium alloy pin materials; palladium was found in the wear track for this experimental condition, while no palladium was found in wear tracks for the other test conditions. Segregation of zinc, silver and copper in wear tracks occurred for all test conditions, but the extent of segregation was dependent on

contact couple combination and heat treatment of the gold alloy plate. The least amount of segregation was observed when the gold alloy plate was age hardened at 426 {degree}C. More segregation occurred for testing in helium than for testing in vacuum with a low partial pressure of oxygen. The largest segregation of metallic elements occurred for laboratory air testing, but the total metallic content of wear tracks was low; the wear tracks consisted primarily of carbon. Segregation was slightly larger with the higher palladium alloy (ASTM B563) pin.

49336 **(SAND—88-1775) Least-squares equalizers for transient signals.** Stearns, S.D. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014705/JAW.

In this report we present specific methods for designing and implementing digital nonrecursive and recursive least-squares equilizers for devices such as cables that are used with transient signals. The equilizers are designed using test signals and are, in the sense described, optimal. Computing routines for designing and implementing both types of equalizers are included.

49337 **(UCRL—98072) Crossatron switch as thyratron replacement in high repetition rate, high average power modulators.** Sullivan, J.S. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 7p. (CONF-880699—8). NTIS, PC A02. Order Number DE88013706/JAW.

From 18. power modulator symposium; Hilton Head, SC, USA (20 Jun 1988).

The Crossatron is a cold cathode, low pressure, gas discharge switch with opening and closing capabilities. Due to its cold cathode operation, the Crossatron may offer lifetime advantages compared to the hydrogen thyratron. Unfortunately, little information regarding Crossatron lifetime and performance in high repetition rate, high average power, pulse modulators exists. Four prototype Crossatron devices, fabricated by Hughes Aircraft, were obtained to evaluate their performance and lifetime in high repetition rate, high average power, pulse modulators that had previously been equipped with hydrogen thyratrons. The prototype Crossatrons were evaluated over a range of operating parameters. Various grid drive, keep alive power levels and triggering schemes were employed in the tests. Switch parameters such as trigger time, anode fall time, jitter, recovery time, peak di/dt, switch efficiency, and the gas pumping effect of the discharge were observed. One Crossatron prototype was also subjected to lifetime tests that accumulated tens of billions of pulses. Lifetime data will be compared to various thyratron models tested similarly.

49338 **(WHC-EP—0167) Evaluation of the Astrophysics, Inc. Mark 100 AT walk-through metal detector.** Swank, R.G. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015596/JAW.

This report documents testing of an Astrophysics Mark 100 AT metal detector by Westinghouse Hanford Company personnel at Hanford, Washington. It describes the selection of test items meeting the DOE requirements and the methods by which they were used to test the metal detector. It provides a collection of data generated by detection sensitivity tests, electrical and radio frequency interference tests, and walk tests performed under laboratory conditions. Test results are included in both raw and graphic form. A synoptic discussion of the tests includes an analysis of the results and conjecture on their impact on field applications. Pertinent information is presented regarding the use of standard test articles. The results of the testing indicate that the metal detection performance of the Astrophysics Mark 100 AT exceeds the literal DOE requirements, but that it has some characteristics which may limit its application at nuclear installations. For example, all the test weapons could easily be detected, but not on any single one of the four factory metal detection programs tested. All shielding test articles could be detected on a single program, but required high sensitivity settings that caused excessive nuisance alarms. However, under special unspecified applications the metal detection performance may be acceptable, even exemplary. It has detection attributes that make it particularly well suited for selectively detecting items of aluminum, mild steel, and austenitic and ferritic stainless steel materials.

49339 **Thermally actuated thermionic switch.** Barrus, D.M.; Shires, C.D. (to Dept. of Energy, Washington, DC). US Patent 4,747,998. 31 May 1988. Filed date 21 Feb 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A thermally actuated thermionic switch which responds electrically to an increase in temperature of thermionic material therein by changing from a high impedance to a low impedance at a predetermined temperature set point is described comprising: an emitter constituting an outer casing of the switch and adapted to be in contact with an associated medium which may undergo a change in temperature, the outer casing having a closed end and an open end, a collector positioned totally within the emitter and separated therefrom by a gap, means for closing the open end of the outer casing formed by the emitter for defining a closed volume within the emitter, electrical lead means connected to the inner surface of the emitter and to the reduced diameter section of the collector and extending through the means for closing the outer casing for connection to an associated power supply and to an associated point of use, and a quantity of thermionic material held in a matrix in a graphite block reservoir, and which is located within the emitter, the thermionic material consisting of metal which ionizes when heated to a temperature above the set point, for electrically connecting the emitter and collector when the thermionic material is ionized.

49340 **Characterization of 820-nm single mode fibers.** Flurer, R.L.; Cordi, A.J.; Colburn, C.W.; Whitcomb, B.M. (EG and G Energy Measurements, Inc., P.O. Box 1912, Las Vegas, NV (US)). pp 82-88 of Fiber optics in adverse environments III. Greenwell, R.A. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1986). (CONF-8609127—).

From SPIE symposium on optics and optoelectronics; Cambridge, MA, USA (14 Sep 1986).

Increasing interest in the use of high bandwidth optical diagnostic measurement systems at the Nevada Test Site (NTS) has prompted the use of single mode fiber (SMF). In an effort to improve the time response of experimental systems designed for use in the 800- to 900-m spectrum, SMF optimized for 850-nm operation has been obtained. Experimental systems to characterize this fiber have been developed. Measurements to determine the fibers' bandwidth, material dispersion, mode field diameter (MFD), cut-off wavelength, numerical aperture (NA), and spectral attenuation have been completed. These experimental data are presented in the text.

49341 **Optical fiber radiation-damage measurements.** Smith, D.E.; Jander, D.R.; Roeske, F. (The Univ. of California, Lawrence Livermore National Lab., Livermore, CA (US)). pp 76-81 of Fiber optics in adverse environments III. Greenwell, R.A. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1986). (CONF-8609127—).

From SPIE symposium on optics and optoelectronics; Cambridge, MA, USA (14 Sep 1986).

The authors made light-transmission measurements of high-purity, radiation-resistant, Raychem and Heraeus optical-fiber samples that had been exposed to 10- and 100-krad doses from 0.5-MeV-electron pulses. An electron beam from a Febetron 706 x-ray machine produced a radiation source that emitted the above doses in single pulses with a full-wavehalf maximum (FWHM) of approximately 1.5 ns. Light sources for the transmission measurements (a mercury/krypton-vapor flashlamp and a laser diode) provided spectral data for a continuous-wavelength band from 420 to 760 nm and a single wavelength at 820 nm. The light beam was dispersed by a grating and recorded by a streak camera. The authors gathered data at times ranging from approximately 3 ns to 1 μ after the radiation pulse.

49342 **Influence of preform variations and drawing conditions on transient radiation effects in pure silica fibers.** Looney, L.D.; Lyons, P.B.; Schneider, W.; Henschel, H. (Los Alamos National Lab., P.O. Box 1663, Los Alamos, NM (US)). pp 37-43 of Fiber optics in adverse environments III. Greenwell, R.A. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1986). (CONF-8609127—).

From SPIE symposium on optics and optoelectronics; Cambridge, MA, USA (14 Sep 1986).

Radiation resistance for several fiber samples is explored, with emphasis on variations in draw temperatures for both low- and high-OH content preforms. For a given preform type, draw temperatures had minimal effect on radiation resistance for transient conditions below 10/sup -7/ s. Dosimetry techniques were intercompared for pulsed electron accelerators. A high purity, high-OH content, fiber was tested for radiation response to determine transient attenuation from 4 ns to 10/sup 4/ s.

4209 Waste Processing Plants And Equipment

49343 **Leak tightness testing of underground tank systems.** Henry, R.K. (Lawrence Livermore National Lab., Livermore, CA (US)). pp 333-338 of Proceedings of the 41st industrial waste conference. Chelsea, MI; Lewis Publishers (1987). (CONF-860527—).

From 41. annual Purdue industrial waste conference; West Lafayette, IN, USA (13 May 1986).

One hundred fifty underground tanks and sumps used to contain petroleum products and potentially contaminated wastewater have given Lawrence Livermore National Laboratory an unusual opportunity to experiment with a variety of leak test methods and compare applicability of each method. Five types of commercially available Precision Test leak test equipment have been used: Associated Environmental Systems, Hunter Leak Lokator, Horner Ezy-Check, Heath Petro-Tite, and Tank Auditor.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 48036, 48074, 48082, 48111, 48163, 48361, 48499, 48500, 48921, 48976

49344 **(DOE/ID—10204) Combustion research opportunities for industrial applications: Final report.** Chace, A.S.; Hazard, H.R.; Levy, A.; Thekdi, A.C.; Ungar, E.W. (Taratec Corp., Columbus, OH (USA)). 31 Mar 1988. Contract AC07-76ID01570. 137p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88014104/JAW.

The purpose of this study was to identify critical combustion technology research and development opportunities which can provide energy savings and other process improvements in major domestic industrial sectors. This report is intentionally focused upon what industry needs, not on what industry is currently doing. This report deals with the combustion system, including heat generation, regulation of stoichiometry, heat transfer to the load, heat loss from processes, combustion control and diagnostic equipment. This report addresses five industrial sectors which are the major users of energy, namely: (1) primary metals; (2) stone, clay and glass; (3) petroleum and chemical: (4) pulp and paper and (5) food and kindred products. Steam generation, because it is a key factor in all industries, is also addressed. 15 refs., 7 figs., 5 tabs.

49345 **(NP—8770367) KONUS - energy from waste products.** (Konus-Kessel, Gesellschaft fuer Waermetechnik m.b.H. und Co. K.G., Schwetzingen (Germany, F.R.)). 1986. 12p. (In German and English). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770367/JAW.

KONUS has developed a combustion system which enables economic energy generation from waste products - the KKV system. This system is of underfeed design with the fuel being transported into the burning chamber by a feed screw. The special features of this system are the round combustion chamber and tangential air nozzles which cause vertical combustion. Depending on the fuel type, a system of secondary and tertiary air nozzles provides air to the grate area. These unique construction characteristics, in particular the high, constant convection properties, of the round burning chamber, allow even traditionally difficult fuel, up to a moisture content of 150% on dry basis depending on the grate configuration, to be burned efficiently. The variety of fuels suitable for the KKV system ranges from wood wastes (e.g. shavings, chips, sander dust or bark), to bagasse, peanut hulls, cotton and coffee wastes. The KONUS product line encompasses thermal oil heaters for pressureless process heat up to 320/sup 0/C, warm and hot water heaters for temperatures up to 200/sup 0/C, and low pressure steam systems. The KKV systems range in unit capacity from 1.6 to 32 million BTU per hour. Modular construction of these systems keeps delivery and installation to a minimum. The burning chamber can be insulated prior to shipment.

49346 **(PB—88-217047/XAB) Development and commercialization of pulse-combustion commercial steam boilers. Final report, April 1984-March 1988.** Belles, F.E.; Hollowell, G.T.; Kardos, P. (Forbes Energy Engineering, Inc., Springfield, MA (USA)). Apr 1988. 92p. NTIS, PC A05/MF A01.

See also report dated April 1987, PB—87-230231.

The final report presents the accomplishments in the area of pulse-combustion-based high-efficiency commercial steam boilers with targeted inputs of 500,000 and 2,000,000 Btu/hr. A fully functional 500,000 Btu/hr experimental low-pressure steam boiler, meeting all performance and cost objectives was developed and built. Equipped with a fully automatic control system, the prototype was also tested at the participating manufacturer's facility and was found to operate acceptably. Design revisions for the conversion to a high pressure (175 psig) variant is in process by the manufacturer.

49347 **(UCRL—98039) Pulse combustor modeling: One dimensional wave-dynamic model utilizing dynamic injection and energy release submodels.** Barr, P.K.; Keller, J.O.; Bramlette, T.T.; Westbrook, C.K. (Lawrence Livermore National Lab., CA (USA)). 11 Jan 1988. Contract W-7405-ENG-48. 21p. (CONF-880802—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005369/JAW.

From 22. international symposium on combustion; Seattle, WA, USA (14 Aug 1988).

A numerical model of a pulse combustor has been developed to simulate the dynamic interactions among major physical processes that control the combustor's operation. In the model the nonlinear wave motion is driven by the periodic injection and combustion processes. This model is fully coupled because these driving processes are related to the pressure and temperature in the combustion chamber, as well as to each other. The dynamic wave pattern is determined by integrating the unsteady, one-dimensional, variable-area equations of continuity, momentum and energy, including losses due to friction and heat transfer. The injection model assumes the reactant flow rate is driven by the calculated pressure drop across a flapper valve. The combustion submodel uses a two-step process to determine the cyclic-varying energy release profile from the injection profile. This submodel first estimates the rate at which the cold reactants mix with the hot products from previous cycles. It then translates this rate of mixing to a rate of energy release based on chemical kinetics calculations. The combination of the submodels for injection and combustion produces a pulse combustor model that is dynamic in nature in that it fully couples the injection and mixing processes to the acoustic waves. 25 refs., 5 figs.

4220 Underground Engineering

REFER ALSO TO CITATION(S) 48096

49348 **(CRIE-U—07) Study on the application of the continuous underground wall to actual RCS structures.** Kanazu, Tsutomu; Aoyagi, Yukio; Endo, Tatsumi; Shiojiri, Hiroo; Aoyagi, Sakae. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Nov 1987. 62p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88753441/JAW.

The continuous underground wall construction method is normally used for constructing very deep underground structures, but this underground wall is a tentative structure and is not consid-

ered to be the main body structure from the design viewpoint. Realizing this, a research to solve technological problems in order to apply this wall to the main body structuree has been conducted and this report summarizes the result of the above research and arranges technological proposals concerning the application of the continuous underground wall to the main body structure. The structure, bending strength and nature of deformation of lap joints installed in the continuous underground wall were revealed by the experiments using large RC beam materials and ring-shaped RC materials, and applicability of FEM analysis was also examined. Concerning quality of concrete to be placed in the mud water during the construction work of the continuous underground wall and the shearing strength performance of lap joints, the results of the researches on the matters in the past were investigated by reviewing reference materials. In consolidating the results of the above researches, it is quite possible to apply the continuous underground wall to the main body structure. (36 figs, 12 tabs, 96 refs)

4230 Marine Engineering

REFER ALSO TO CITATION(S) 49120

49349 **(DE—TP3405E) Concepts for icebreakers with integral fluid cushion bow.** Livingstone, F.R.; George, M.F. (Davis Engineering Ltd., Ottawa, Ontario (Canada)). Dec 1981. 92p. (CE—01678). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objective of this study was to define preliminary concepts for integration of a fluid cushion (air or water) into the bow of an icebreaker, and to provide a work plan for the theoretical and experimental analysis of the recommended concept. The general objective was to achieve a reduction of the energy required by icebreakers when breaking an ice cover. This report represents three conceptual designs for integrating the fluid cushion icebreaking principles into a ship. These concepts are extended bow with air cushion/water curtain, twin-bow arrangement, and conventional bow with air cushion/water curtain principles. Analogy is then made between the air cushion icebreaker bow (ACIB) configurations and the proposed concepts for preliminary evaluation. The idea of using water jets for ice cutting is also pursued and the limitations are identified. A preliminary dynamic analysis of a water curtain is carried out and the parameters affecting both the structure of the jet stream and its configuration, under static condition, are outlined. Finally a work plan is presented for the follow-on study which includes both the theoretical and experimental analysis for the three concepts. Meanwhile, in light of this limited study, the first concept is likely to be recommended for Arctic operations, while the second may be suitable for icebreaking in light ice conditions, and the third for enhancing the icebreaking capabilities of existing vessels in their prospective classes. 12 refs., 29 figs., 2 tabs.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 49524

4250 Power Cycles

REFER ALSO TO CITATION(S) 48395, 48410, 49307

43 PARTICLE ACCELERATORS

REFER ALSO TO CITATION(S) 50126

49350 **(CERN—87-11-Vol.1) New developments in particle acceleration techniques. Proceedings. Vol. 1.** Turner, S. (ed.). (European Organization for Nuclear Research, Geneva (Switzerland)). 12 Oct 1987. 348p. (ECFA—87/110-Vol.1; CONF-8706147—Vol.1). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88900326/JAW.

From Workshop on new developments in particle acceleration techniques; Orsay, France (29 Jun 1987).

A Workshop organised jointly by the European Committee for Future Accelerators (ECFA), the CERN Accelerator School (CAS), the Institut National de Physique Nucleaire et de Physique des Particules (IN2P3), the Institut pour la Recherche Fondamentale/Commissariat a l'Energie Atomique (IRF/CEA) and the European Physical Society (EPS) was held at the Laboratoire de l'Accelerateur Lineaire (LAL), Orsay, from 29 June to 4 July 1987. Its purpose was to review current experimental and theoretical developments in charged-particle accelerator techniques and to address problems related to future very-high-energy machines. These proceedings contain the great majority of the papers presented at the Workshop, the corresponding questions and answers, and the round-table discussion. The principal topics were semi-conventional high-frequency linacs, transformer acceleration mechanisms, acceleration using plasma, e/sup +/e/sup -/ sources including low-emittance production and preservation, final focus and interaction point, and other new ideas. Among the latter were open accelerating structures, crystal X-ray accelerators, ferroelectrics, and acceleration using lasers.

49351 **(CERN—87-11-Vol.2) New developments in particle acceleration techniques. Proceedings. Vol. 2.** Turner, S. (ed.). (European Organization for Nuclear Research, Geneva (Switzerland)). 12 Oct 1987. 366p. (ECFA—87/110-Vol.2; CONF-8706147—Vol.2). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88900325/JAW.

From Workshop on new developments in particle acceleration techniques; Orsay, France (29 Jun 1987).

A Workshop organised jointly by the European Committee for Future Accelerators (ECFA), the CERN Accelerator School (CAS), the Institut National de Physique Nucleaire et de Physique des Particules (IN2P3), the Institut pour la Recherche Fondamentale/Commissariat a l'Energie Atomique (IRF/CEA) and the European Physical Society (EPS) was held at the Laboratoire de l'Accelerateur Lineaire (LAL), Orsay, from 29 June to 4 July 1987. Its purpose was to review current experimental and theoretical developments in charged-particle accelerator techniques and to address problems related to future very-high-energy machines. These proceedings contain the great majority of the papers presented at the Workshop, the corresponding questions and answers, and the round-table discussion. The principal topics were semi-conventional high-frequency linacs, transformer acceleration mechanisms, acceleration using plasma, e/sup +/e/sup -/ sources, including low-emittance production and preservation, final focus and interaction point, and other new ideas. Among the latter were open accelerating structures, crystal X-ray accelerators, ferroelectrics, and acceleration using lasers.

49352 **(LA—11295-SR) Accelerator Technology Program: Status report, October 1985--March 1986: Volume 1.** Jameson, R.A.; Schriber, S.O. (comps.). (Los Alamos National Lab., NM (USA)). Jul 1988. Contract W-7405-ENG-36. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88015049/JAW.

This report presents highlights of the major projects in the Accelerator Technology (AT) Division of the Los Alamos National Laboratory. The first section details progress associated with the accelerator test stand. Following sections cover achievements in accelerator theory and simulation, LAMPF II accomplishments, and updates on BEAR, beam dynamics, the rf laboratory, p-bar gravity experiment, University of Illinois racetrack microtron, and NBS microtron. Also included are results from the Proton Storage Ring commissioning, developments in very high microwave systems, and advances in the Fusion Materials Irradiation Test rf technology. In addition, the Phoenix Project and the Krypton Fluoride Project are discussed. The report concludes with a listing of papers published by AT-Division personnel during this reporting period. 42 figs., 5 tabs.

49353 **Proceedings of the 1987 IEEE particle accelerator conference: Volume 2.** Lindstrom, E.R.; Taylor, L.S. (eds.). Piscataway, NJ; Institute of Electrical and Electronics Engineers, Inc. (1987). 704p. IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. Contract FG02-87ER40337.

From Particle accelerator conference; Washington, DC, USA (16 Mar 1987).

This report contains papers from the IEEE particle accelerator conference. This second volume of three covers the following main topics: Instrumentation and control, accelerators for medium energies and nuclear physics, high current accelerators, and beam dynamics. (LSP)

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 49397, 49860

49354 (CERN/EP—88-28) Perspectives of underground physics: The Gran Sasso Project. Zichichi, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 1 Mar 1988. 28p. (CONF-8711199—1). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012616/JAW.

From Symposium on present trends: concepts and instruments of particle physics; Rome, Italy (3 Nov 1987).

This paper discusses the design of the Gran Sasso underground physics laboratory. The physics that will be investigated by this lab is discussed also. 4 refs., 14 figs., 3 tabs. (LSP)

49355 (CERN-EP—88-30) A one racetrack superconducting accelerator complex for bottom quark and nuclear physics studies. Amaldi, U.; Coignet, G. (European Organization for Nuclear Research, Geneva (Switzerland)). 4 Mar 1988. 9p. (CONF-871299—2). NTIS (US Sales Only), PC A02; 1; GPO Dep. Order Number DE88012617/JAW.

From Workshop on heavy quarks factory and nuclear physics facility with superconducting linacs; Courmayeur, Italy (14 Dec 1987).

In this note we show that a simplified design of our accelerator complex, based on a single racetrack, satisfies the requests expressed at the Courmaycur Workshop both for B-{bar B} studies and nuclear physics. Further possibilities for heavy quark and Z studies would still be open for the future, and the same detector can study c{bar c} and {tau}{bar {tau}} production with large luminosities. The complications and the cost of such an accelerator complex are less than the one of previous designs, but some technical aspects as the recirculators have still to be looked at in detail. 14 refs., 2 figs., 1 tab.

49356 (CERN-EP—88-32) Origin, development and status of the superconducting radiofrequency complex. Amaldi, U. (European Organization for Nuclear Research, Geneva (Switzerland)). 9 Mar 1988. 18p. (CONF-871299—1). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012618/JAW.

From Workshop on heavy quarks factory and nuclear physics facility with superconducting linacs; Courmayeur, Italy (14 Dec 1987).

This paper discusses the design of superconducting cavity accelerators. Beam luminosities, limiting factors and other acceleration characteristics are described. 41 refs., 11 figs., 2 tabs.

49357 (DOE/ER/40301—1) Conference on advanced accelerator concepts: Final technical report. (Wisconsin Univ., Madison (USA)). 1986. Contract FG02-86ER40301. 6p. (CONF-8608123—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014054/JAW.

From Advanced accelerator concepts conference; Madison, WI, USA (21 Aug 1986).

Since the first workshop on laser acceleration of particles held at Los Alamos in 1982, there has been steady growth and evolution into a field substantially broader than laser driven accelerators. The primary goal is the acceleration of particles to very high energies for the study of elementary particle physics, but developments have the potential of much wider application. There follows summaries of major topics discussed at the symposium.

49358 (SAND—88-0091) Design of electron beam accelerators for microwave application. Prestwich, K.R. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015411/JAW.

Relativistic electron beams are used for generating high power microwaves. These microwave sources require electron beam generators spanning significant ranges in voltage and impedance. The pulsed power technology used to generate these electron beams is presented. Electron beam generators that produce beams with pulse durations in the 10-ns to 100-ns regime consist of an energy-storage section, pulse-shaping section, and an electron beam diode. The energy-storage section is either a Marx generator or capacitor bank-pulsed transformer. The pulse shaping is done with high-voltage transmission lines. The electron beam diode is usually a cold-cathode, space-charge-limited flow device. For longer pulses ({approximately}1 μs) the energy storage and pulse chaping can be combined. Lumped-element pulse-forming networks (PFN) can be designed to produce the desired pulse shape. The Marx generator becomes one of the elements of the PFN. Alternatively, a low voltage PFN followed by a highly coupled transformer can be used. Basic design principles for all of the above subsystems are discussed. Both PFLs and PFNs can also be operated as inductive-storage systems with opening switches. 32 refs., 16 figs., 1 tab.

49359 (TRI-PP—88-34) The upgrading of the TRIUMF facility to 500 {mu}A operation. Dutto, G.; Baartman, R.; Blackmore, E.W.; Dohan, D.A.; Laxdal, R.; Mackenzie, G.H.; Kendall, K.R.; Otter, A.; Schmor, P.W.; Worsham, R.; Zach, M. (TRIUMF, Vancouver, British Columbia (Canada)). Jun 1988. 3p. (CONF-880695—42). NTIS (US Sales Only), PC A02. Order Number DE88013266/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

Over the last few years, operational beam intensity levels at TRIUMF have been around 150 {mu}A at 500 MeV. As a result of recent improvements to the ion source and the rf resonator system, an extracted beam current of 420 {mu}A in a 50{percent} duty cycle was demonstrated, and one week of 200 {mu}A beam production successfully completed. This gave confidence that the original design goal of 100 {mu}A cw operation can be raised to 500 {mu}A. Modifications will be necessary in several regions of the machine to prevent beam-induced damage or excessive activation of components. In particular, the axial injection line, the central region of the cyclotron, the external beam line and the primary production targets will be upgraded and new diagnostics and beam spill protection systems added. The dee voltage will be increased to above 100 kV and two auxiliary accelerating cavities will be used to provide an overall 1 MeV energy gain per turn over the 400{endash}500 MeV region, resulting in a threefold reduction (to below 3{percent}) of electromagnetic stripping losses. This paper will focus on present and future limitations to increasing the current and describe major design concepts of the program. 12 refs., 3 figs.

49360 (UCRL—99182) Overview of linear induction accelerators. Briggs, R.J. (Lawrence Livermore National Lab., CA (USA)). 15 Jul 1988. Contract W-7405-ENG-48. 18p. (CONF-880888—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014177/JAW.

From Free electron laser seminar; Beijing, China (11 Aug 1988).

In this paper, we survey the US induction linac technology, emphasizing electron machines. We also give a simplified description of how induction machines couple energy to the electron beam to illustrate many general issues that designers of high-brightness and high-average-power induction linacs must consider. We give an example of the application of induction accelerator technology to the relativistic klystron, a power source for high-gradient accelerators. 8 figs., 1 tab.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 49356, 49870

49361 (AD-A—193100/5/XAB) Research opportunities below 300 nm at the NBS free-electron-laser facility. Debenham, P.H.; Johnson, B.C. (National Bureau of Standards, Washington, DC (USA)). 1987. 6p. NTIS, PC A02/MF A01.

A free-electron laser (FEL) that will be driven by the c-w racetrack microtron (RTM), will be operated as an oscillator with the fundamental wavelength variable from approximately 200 nm to 10 micrometers. The presence of harmonics should allow for operation in the VUV and EUV spectral regions. The c-w RTM consists of a 5-MeV injector section and a 12-MeV, c-w, rf linear accelerator (linac). The linac is placed between the uniform field end magnets that recirculate the beam on successive orbits through the linac. The beam can be deflected out of the RTM after completing up to and including 15 passes through the linac, so that the final beam energy is 17 to 185 MeV. As an FEL driver, the unique features of the RTM are the c-w nature of the beam, excellent energy stability, small values of the transverse emittance and energy spread, and high average power.

49362 (BNL—41392) A study of the coupling resonances in the AGS Booster. Lee, S.Y.; Tepikian, S.; Zhao, X.F. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 4p. (CONF-880695—22). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012888/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

Analytic method is used to analyze the tracking results for the AGS-BOOSTER lattice. We found the amplitude dependence of the tune is very important in understanding characteristic of the tracking result. With the perturbed tune, the effective second order perturbation theory work very well. The method can be used to analyze the optimized operational condition for the lattice. For the Booster, the analysis suggests that chromaticity of {minus}2 and {minus}5 and a minimum unperturbed tune split chemical bond{Delta}{nu}{sup 0}chemical bond > 0.01. At the zero chromaticity point, the required unperturbed tune split is considerably larger in order to obtain a similar performance. 7 refs., 4 figs.

49363 (BNL—41426) Chromaticity calculations and code comparisons for x-ray lithography source XLS and SXLS rings. Parsa, Z. (Brookhaven National Lab., Upton, NY (USA)). 16 Jun 1988. Contract AC02-76CH00016. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015194/JAW.

This note presents the chromaticity calculations and code comparison results for the (x-ray lithography source) XLS (Chasman Green, XUV Cosy lattice) and (2 magnet 4T) SXLS lattices, with the standard beam optic codes, including programs SYNCH88.5, MAD6, PATRICIA88.4, PATPET88.2, DIMAD, BETA, and MARYLIE. This analysis is a part of our ongoing accelerator physics code studies. 4 figs., 10 tabs.

49364 (BNL—41462) Simulation of proton RF capture in the AGS Booster. Khiari, F.Z.; Luccio, A.U.; Weng, W.T. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 5p. (CONF-880695—50). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015190/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

RF capture of the proton beam in the AGS Booster has been simulated with the longitudinal phase-space tracking code ESME. Results show that a capture in excess of 95% can be achieved with multiturn injection of a chopped beam.

49365 (BNL—41465) Transverse space-charge effects in the AGS booster during injection. Colton, E.P.; Shi, D.; Parsa, Z. (Brookhaven National Lab., Upton, NY (USA)). 29 Apr 1988. Contract AC02-76CH00016. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015193/JAW.

We have analyzed the transverse motion for 200 MeV protons under strong space-charge conditions. We considered up to 5 {times} 10^{13} protons per bunch; for the assumed distribution this corresponds to a maximum tune shift of {minus}0.75. We utilized single particle tracking to study the motion in normalized phase space as a function of initial particle amplitude. Subsequent FFT analyses were used to obtain the fractional betatron tunes at different z values along the bunch. The motion shows x {minus} y coupling due to the so-called Montague resonance (2Q/sub x/{minus}2Q/sub y/{equals}0). Perturbations arise when particles have tunes in the neighborhood of the 2Q {equals} 9 half-integral resonances but losses do not occur. It appears that the motion is stabilized simply due to the strong amplitude dependence of the tunes. 2 refs., 5 figs., 4 tabs.

49366 (EGG-PHY—8123) Analysis of accelerator beam data project report. Siegel, S.; O'Brien, T.; Stratton, D.; Knox, J. (EG and G Idaho, Inc., Idaho Falls (USA); Idaho State Univ., Pocatello (USA)). Jun 1988. Contract AC07-76ID01570. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015187/JAW.

Idaho State University Physics Department is assisting the Idaho National Engineering Laboratory in the analysis of beam monitor data taken during an electron accelerator experiment conducted at the Lawerence Livermore National Laboratory in 1987. The beam monitor data are contained on videotapes which show oscilloscope frames of the beam intensity pulses. Idaho State's involvement is to evaluate the integrated intensity of each pulse. 1 fig., 5 tabs.

49367 (FNAL/C—88/57) Equivalence of two formalisms for calculating higher order synchrotron sideband spin resonances. Mane, S.R. (Fermi National Accelerator Lab., Batavia, IL (USA)). 11 May 1988. Contract AC02-76CH03000. 21p. (CONF-880983—1). NTIS, PC A03. Order Number DE88012221/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

Synchrotron sideband resonances of a first order spin resonance are generally regarded as the most important higher order spin resonances in a high-energy storage ring. Yokoya's formula for these resonances is rederived, including some extra terms, which he neglected, but which turn out to be of comparable magnitude to the terms retained. Including these terms, Yokoya's formalism and the SMILE algorithm are shown to be equivalent to leading order in the resonance strengths. The theoretical calculations are shown to agree with certain measurements from SPEAR.

49368 (FNAL/C—88/87) Bunch coalescing and bunch rotation in the Fermilab Main Ring: Operational experience and comparison with simulations. Martin, P.S.; Wildman, D.W. (Fermi National Accelerator Lab., Batavia, IL (USA)). 1 Jul 1988. Contract AC02-76CH03000. 8p. (CONF-880695—54). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015578/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

The Fermilab Tevatron I proton-antiproton collider project requires that the Fermilab Main Ring produce intense bunches of protons and antiprotons for injection into the Tevatron. The process of coalescing a small number of harmonic number h=1113 bunches into a single bunch by bunch-rotating in a lower harmonic rf system is described.The Main Ring is also required to extract onto the antiproton production target bunches with as narrow a time spread as possible. This operation is also discussed. The operation of the bunch coalescing and bunch rotation are compared with simulations using the computer program ESME. 2 refs., 8 figs.

49369 **(FNAL-TM—1535) Explanation of persistent high frequency density structure in coalesced bunches.** Jackson, Gerald P. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jul 1988. Contract AC02-76CH03000. 15p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015525/JAW.

It has been observed that after the Main Ring rf manipulation of coalescing (where 5 to 13 primary bunches are transferred into a single rf bucket) the new secondary bunch displays evidence of high frequency density structure superimposed on the approximately Gaussian longitudinal bunch length distribution. This structure is persistent over a period of many seconds (hundreds of synchrotron oscillation periods). With the help of multiparticle simulation programs, an explanation of this phenomenon is given in terms of single particle longitudinal phase space dynamics. No coherent effects need be taken into account. 6 refs., 10 figs.

49370 **(LA-UR—88-1827) Optics code development at Los Alamos.** Mottershead, C.T.; Lysenko, W.P. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-880178—8). NTIS, PC A02/MF A01; GPO Dep. Order Number DE88014457/JAW.

From Workshop on accelerator and beam optics codes; San Diego, CA, USA (19 Jan 1988).

This paper is an overview of part of the beam optics code development effort in the Accelerator Technology Division at Los Alamos National Laboratory. The aim of this effort is to improve our capability to design advanced beam optics systems. The work reported is being carried out by a collaboration of permanent staff members, visiting consultants, and student research assistants. The main components of the effort are: building a new framework of common supporting utilities and software tools to facilitate further development; research and development on basic computational techniques in classical mechanics and electrodynamics; and evaluation and comparison of existing beam optics codes, and support for their continuing development. 17 refs.

49371 **(LA-UR—88-2109) Annular beam-driven high-gradient accelerators.** Keinigs, R.; Jones, M.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-880713—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014415/JAW.

From 7. international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

During the past several years there has been an increasing interest in using wakefield acceleration techniques as a means for achieving TeV energies with the next generation of linear colliders. The principal design goals for a wakefield accelerator that is to be sued in this context are high accelerating gradients and large transformer ratios. Fundamentally any slow wave structure can function as a wakefield accelerator, and several interesting concepts have been proposed. In this paper we consider for the slow wave structure a dielectrically loaded waveguide. The Dielectric Wakefield Accelerator is a very simple device. The geometry consists of a gapless cavity filled with a dielectric. The dielectric may fill all or just part of the cavity. Here we investigate driving the system with an intense annular beam, so the dielectric is separated from the wall by a vacuum region in which this beam is propagated. The primary advantage of driving with an annular beam is that larger currents can be achieved, and thus larger accelerating gradients can be generated. The drive beam is stabilized by a strong, axial magnetic field. The wall is coated with a dielectric liner to provide for better coupling. A small hole is drilled in the center of the dielectric to allow for the passage of a low current, witness beam.

49372 **(LBL—25335) Estimation of intrabeam scattering effects for Relativistic Heavy Ion Collider (RHIC).** Zisman, M.S. (Lawrence Berkeley Lab., CA (USA)). May 1988. Contract AC03-76SF00098. 14p. (CONF-880335—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014861/JAW.

From Workshop on the relativistic heavy ion collider performance; Upton, NY, USA (21 Mar 1988).

The effects of intrabeam scattering on the beam dimensions and energy spread of a 100 GeV/amu gold beam are estimated. After 10 hours, growth of the transverse emittance is about a factor of three, with a similar growth in momentum spread. These findings are in agreement with earlier results of Parzen. Sensitivity of the results to the initial beam conditions is explored. In addition, calculations have been carried out for the case of high frequency (214 MHz) RF system. In this case the growth is more severe, giving a fivefold increase in transverse emittance. To ensure that the momentum spread after 10 hours does not exceed the RF momentum acceptance, a voltage in excess of 32 MV would be needed. 5 refs., 4 figs., 3 tabs.

49373 **(LBL—25382) Damping transverse oscillations of bunches in RHIC.** Lambertson, G.R. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 5p. (CONF-880335—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014860/JAW.

From Workshop on the relativistic heavy ion collider performance; Upton, NY, USA (21 Mar 1988).

To examine one aspect of the feasibility of suppressing transverse coupled-bunch motion, an estimate of the kicker power and bandwidth will be made. We expect that large power will not be required, so that the kicker electrode need not provide maximum coupling. This also reduces its contribution to the beam impedance, which is calculated at the end of this paper. 1 ref., 1 fig.

49374 **(SLAC-PEP-NOTE—168) Note on longitudinal beam polairzation.** Wenzel, W.A. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). [1988]. Contract AC03-76SF00515. 9p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015165/JAW.

Longitudinal beam polarization achieved through g-2 precession is examined for the dependence of the power emitted as synchrotron radiation on the free length at the intersection. Using only dipoles for dispersion, the power doubles for every three meters of free length. The power can be reduced by using existing focusing elements to increase the dispersion, but this procedure also limits the luminosity because of chromatic aberration.

49375 **(SLAC-PEP-NOTE—169) Resonance method to produce a polarisation asymmetry in electron-positron storage rings.** Toner, W.T. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). [1988]. Contract AC03-76SF00515. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015164/JAW.

Pulsed solenoids of a few tens of ampere turns, operated in synchronism with the $\gamma(g-2/2)$ 'th harmonic of the orbit period, can be used to prevent a stored electron beam from becoming polarised through the emission of synchrotron radiation. With such low fields it is easy to arrange that only some of the stored bunches are affected. This makes it possible to produce collisions between counter-rotating electrons and positrons stored in a single ring in which the electron and positron polarisations are not equal and opposite. 8 refs.

49376 **(UCRL—99187) High current electron-beam transport in induction linacs.** Caporaso, G.J.; Briggs, R.J. (Lawrence Livermore National Lab., CA (USA)). 15 Jul 1988. Contract W-7405-ENG-48. 18p. (CONF-880888—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014178/JAW.

From Free electron laser seminar; Beijing, China (11 Aug 1988).

This paper will discuss issues in beam dynamics that are relevant to high current electron linear induction accelerators. The problems fall into two general areas: emittance growth and development of transverse motion of the beam centroid. The effects on nonlinear space charge forces on emittance growth will be discussed, and a differential equation relating emittance growth to changes in beam spatial profile will be derived. In addition, two mechanisms giving rise to unwanted transverse motion of the beam centroid will be discussed. One mechanism, called "corkscrew," arises from the combination of a dispersive transport system and energy variation through the pulse. The second mechanism, the beam breakup (BBU) instability, results from the interaction of the beam with the TM{sub 1m0} modes of the accelerating cavities.

Growth laws for both mechanisms will be presented. 10 refs., 7 figs.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 49276, 49293, 49356, 49398, 49878, 50246, 50247

49377 **(BNL—41437) Advanced concepts in accelerator timing control.** Frankel, R.; Salwen, C. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 3p. (CONF-880695—43). NTIS, PC A02. Order Number DE88013991/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

The control system for the Booster accelerator presently under construction at BNL includes a timing section with serial high speed coded data distribution, computer based encoders for both real time and field driven clocks and a method of easily tracking the performance and reliability of these timing streams. We have developed a simple method for the generation of timing which operates to produce pulses which may be repeated as desired with minimal latency.

49378 **(BNL—41438) The AGS Booster control system.** Frankel, R.; Auerbach, E.; Culwick, B.; Clifford, T.; Mandell, S.; Mariotti, R.; Salwen, C.; Schumburg, N. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 3p. (CONF-880695—44). NTIS, PC A02. Order Number DE88013990/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

Although moderate in size, the Booster construction project requires a comprehensive control system. There are three operational modes: as a high intensity proton injector for the AGS, as a heavy ion accelerator and injector supporting a wide range of ions and as a polarized proton storage injector. These requirements are met using a workstation based extension of the existing AGS control system. Since the Booster is joining a complex of existing accelerators, the new system will be capable of supporting multiuser operational scenarios. A short discussion of this system is discussed in this paper.

49379 **(BNL—41444) A tool for symmetry studies in circular machines.** Bozoki, E. (Brookhaven National Lab., Upton, NY (USA)). May 1988. Contract AC02-76CH00016. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015714/JAW.

The use of the C [mrad/Amp] conversion factors of the orbit corrector magnets in the sudy of the symmetry properties of a circular accelerator or storage ring, and in the determination of the ratios of the β-functions at corrector locations is discussed. Measurements obtained for the VUV and x-ray rings of the NSLS at Brookhaven National Laboratory are presented. 4 refs., 7 figs., 3 tabs.

49380 **(BNL—41461) Status of the AGC Booster project.** Weng, W.T. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 3p. (CONF-880695—52). NTIS, PC A02. Order Number DE88015191/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

To meet the needs of new experiments in high energy and nuclear physics, a rapid-cycling Booster for the AGS has been under construction at Brookhaven. For each mode of operation there are corresponding accelerator physics and design issues that need special attention. Problems pertinent to any single mode of operation have been encountered and solved before, but putting high intensity proton requirements and high vacuum heavy ion requirements into one machine demands careful design considerations and decisions. The lattice design and magnet characteristics will be briefly reviewed. Major design issues will be discussed and design issues will be discussed and design choices explained. And finally, the construction status and schedule will be presented. 6 refs., 5 figs., 1 tab.

49381 **(BNL—41463) Tha AGS Booster high frequency rf system.** Sanders, R.; Cameron, P.; Damn, R.; Goldman, M.; Jablonski, E.; Keane, J.; McNerney, A.; Meth, M.; Plotkin, M.; Puglisi, M.; Ratti, A. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 3p. (CONF-880695—51). NTIS, PC A02. Order Number DE88015192/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

A high level rf system, including a power amplifier and cavity has been designed for the AGS Booster. It covers a frequency range of 2.4 to 4.2 Mhz and will be used to accelerate high intensity proton, and low intensity polarized proton beams to 1.5 GeV and heavy ions to 0.35 GeV per nucleon. A total accelerating voltage of up to 90kV will be provided by two cavities, each having two gaps. The internally cross-coupled, pushpull cavities are driven by an adjacently located power amplifier. In order to accommodate the high beam intensity, up to 0.75 {times} 10^{13} protons per bunch, a low plate resistance power tetrode is used. The tube anode is magnetically coupled to one of the cavity's two paralleled cells. The amplifier is a grounded cathode configuration driven by a remotely located solid state amplifier.

49382 **(FNAL-TM—1533) Prospects for 6 to 10 tesla magnets for a TEVATRON upgrade.** Mantsch, Paul M. (Fermi National Accelerator Lab., Batavia, IL (USA)). 8 Jul 1988. Contract AC02-76CH03000. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015527/JAW.

The first SSC physics is at least 10 years away. An upgrade of the Fermilab Tevatron will ensure the continuity of a vigorous high-energy physics program until the SSC turns on. Three basic proposals are under consideration: {bar p}p at 3 {times} 10^{31} --Increase luminosity by improvements to the p source. pp at 1 TeV and 2 {times} 10^{32}--Move the main ring to a new tunnel, build a second Tevatron ring, and {bar p}p > 1.5 TeV and 7 {times} 10^{30}--Replace the tevatron with a higher energy ring. The last two options requires about a hundred 6.6-tesla dipoles in addition to a ring of Tevatron strength (4.4 T) magnets. These higher-field magnets are necessary in both rings to lengthen the straight sections in order to realize the collision optics. The third option requires a ring of magnets of 6.6 T or slightly higher to replace the present Tevatron plus a number of special 8--9 tesla magnets. The viability of the high-energy option then depends on the practicality of sizable numbers of reliable 8--9 tesla dipoles as well as 800 6.6-tesla dipoles. The following develops a specification for an 8.8 T dipole, examines the design considerations and reviews the current state of high-field magnet development. 22 figs., 3 tabs.

49383 **(LA-UR—88-2029) Simulation of plasma erosion opening switches.** Mason, R.J.; Jones, M.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-880713—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014425/JAW.

From 7. international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

Recent progress in the modeling of Plasma Erosion Opening Switches is reviewed, and new results from both fluid and particle simulation compared. Three-fluid simulations with the ANTHEM code for switches on the NRL GAMBLE I machine and SNL PBFA II machine have shown strong dependence of the opening dynamics on the anode structure, the threshold for electron emission, on the possible presence of anomalous resistivity, and on advection of the magnetic field with cathode emitted electrons. Simulations with the implicit particle-in-cell code ISIS confirm these observations, but manifest broader current channels—in better agreement with GAMBLE I experimental results. 7 refs., 3 figs.

49384 **(LA-UR—88-2374) Lasers for switched-power linacs.** Bigio, I.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-8803129—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014334/JAW.

From 4. workshop on laser switched power accelerators; Erice, Italy (4 Mar 1988).

Laser-switched power surges for particle accelerators, just as with direct laser-driven accelerator schemes, place unique demands

on the specifications of the invoked laser systems. We review the laser requirements for switched power sources of the types described in other chapters of this volume. The relative advantages and disadvantages of selected lasers are listed, and the appropriateness and scalability of existing technology is discussed. 4 refs., 2 figs., 2 tabs.

49385 **(LBL—25101) Progress on a 2-MV injector for a scaled HIF accelerator experiment.** Rutkowski, H.L.; Faltens, A.; Humphries, S. Jr.; Vanecek, D.; Pike, C.; Johnson, R.M.; Meyer, E.A. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098;W-7405-ENG-36. 16p. (CONF-8806101—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014870/JAW.

From International symposium on heavy ion inertial fusion; Darmstadt, F.R. Germany (28 Jun 1988).

A sixteen beam injector to supply 500mA per beam of C^+ ions, which was initially designed and partially constructed at Los Alamos National Laboratory, is under further development at LBL. We report on development work involving single and multiple carbon arc sources. These sources are useful because they can easily supply the 25 mA/cm² needed for the device. They are pulsed sources which do not cause unacceptable background gas loads in the column. We present emittance and reproducibility data. Acceleration is by a high gradient column using a succession of aperture lenses to focus the beam. The electrodes are arranged with holes for parallel beams inside 28 inch alumina insulators. Data on beam propagation and electron trapping in the column is presented. The acceleration potential is provided by a Marx bank with inductive grading along the structure. The resulting 34 μsec rise time pulse allows the accelerating potential to equilibrate along the column before the current is injected. Acceleration occurs during a 1 μsec window at the peak of the pulse, kn which the voltage is flat within 0.1%. 8 refs., 7 figs.

49386 **(LBL—25220) A 2-MV multi-beam injector for heavy ion fusion.** Rutkowski, H.L.; Faltens, A.; Vanecek, D.; Pike, C.; Humphries, S. Jr.; Meyer, E.A. (Lawrence Berkeley Lab., CA (USA); Los Alamos National Lab., NM (USA)). Jun 1988. Contract AC03-76SF00098;W-7405-ENG-36. 5p. (CONF-880713—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014871/JAW.

From 7. international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

Construction of a sixteen beam (0.5 A per beam) injector for use in scaled heavy ion fusion experiments is underway at LBL. The machine was designed and partially constructed at LANL. The injector is designed to use carbon arc sources which will provide 25 mA/cm² of extractable current density. The plasma from the arcs is confined electrostatically from drifting into the ion gun before firing the extraction pulse. The acceleration column consists of a set of aperture lenses which both transport the beam and attenuate backstreaming electrons. The acceleration column is mounted inside a 28-inch diameter brazed alumina insulating module. The high voltage for the injector is provided by an inductively loaded and graded Marx generator which resides inside a pressure vessel filled with a 65 psig mixture of 30{percent} SF_6 and 70{percent} N_2. Data is presented showing the performance of single and multiple carbon arc sources. Measurements show that adequate current density is available. Emittance measurements and efforts to improve emittance and reproducibility are shown. Tests with a 5-tray section of the full 18 tray generator are described showing the evolution of the generator design. 5 refs., 3 figs.

49387 **(LBL—25385) Beam impedances of position monitors, bellows, and abort kicker.** Lambertson, G.R.; Ng, K-Y. (California Univ., Berkeley (USA)). May 1988. Contract AC03-76SF00098. 13p. (CONF-880335—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014866/JAW.

From Workshop on the relativistic heavy ion collider performance; Upton, NY, USA (21 Mar 1988).

The miscellaneous components of an accelerator may contribute a substantial or even dominant part of the interaction between beam and surroundings. We have estimated the beam impedances of a few of these components. When needed, we have added our own conceptions to the descriptions available at the Workshop on the RHIC Performance in order to make definite the calculations of impedance. These assumed parameters, while not unique, hopefully illustrate feasible and typical designs. 8 refs., 4 figs., 2 tabs.

49388 **(PNL-SA—15443) An ion-optical bench for testing ion source lenses.** Stoffel(s), J.J.; Ells, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 9p. (CONF-8806199—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013186/JAW.

From 36. annual conference on mass spectrometry and allied topics; San Francisco, CA, USA (6 Jun 1988).

An ion-optical bench has been designed and constructed to obtain experimental data on the focusing properties of ion lenses in three dimensions. The heart of the apparatus is a position-sensitive detector (PSD) that gives output signals proportional to the x and y positions of each ion impact. The position signals can be displayed on an oscilloscope screen and analyzed by a two-parameter pulse-height analyzer, thereby giving a visual picture of the ion beam cross section and intensity distribution. The PSD itself is mounted on a track and is movable during operation from a position immediately following the ion lens to 30 cm away. This enables the rapid collection of accurate data on the intensity distribution and divergence angles of ions leaving the source lens. Examples of ion lens measurements are given. 5 refs., 5 figs.

49389 **(SLAC-PEP-NOTE—173) An alternate way of measuring beam polarization at an e^+ e/sup {minus}/ colliding beam facility.** Buchholz, D.; Manning, G.; Prescott, C. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). [1988]. Contract AC03-76SF00515. 14p. (PEP—173). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015171/JAW.

The scattering of the electron (positron) beam from a low energy polarized electron beam is considered for monitoring beam polarization. The scattered and recoil electrons would be detected in coincidence. Significant asymmetries are predicted for both longitudinal on longitudinal and transverse on transverse polarizations. Use of the method is limited primarily by the absence of intense sources of polarized electrons. Possible future developments are discussed.

49390 **(TRI-PP—88-16) Cost optimization of the AHF booster energy.** Craddock, M.K.; Wienands, U. (TRIUMF, Vancouver, British Columbia (Canada)). Mar 1988. 3p. (CONF-880263—10). NTIS (US Sales Only), PC A02; 1; GPO Dep. Order Number DE88013262/JAW.

From Accelerator design workshop; Los Alamos, NM, USA (22 Feb 1988).

The effect of booster energy on the cost of the AHF has been investigated. Increasing its energy raises the cost of the booster but lowers that of the main ring, creating a minimum in total cost. It is shown that this minimum occurs where the apertures of the booster and the main ring magnets are simultaneously matched to the beam emittance. For high intensity ({approximately}100 {mu}A) boosters, such as LAMPF II, the minimum is quite pronounced. For lower intensity ({approximately}25 {mu}A) boosters, (such as the AHF) it is shallower and other considerations may outweigh those of cost in choosing the energy. 3 refs., 4 figs., 2 tabs.

49391 **(UCRL—97738) Impedance characteristics of induction accelerator cells.** Turner, W.C.; Caporaso, G.L.; Craig, G.D.; DeFord, J.F.; Reginato, L.L.; Sampayan, S.; Kuenning, R.W.; Smith, I.D. (Lawrence Livermore National Lab., CA (USA); Pulse Sciences, Inc., San Leandro, CA (USA)). 1988. Contract W-7405-ENG-48. 13p. (CONF-880713—13). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014803/JAW.

From 7. international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

In this paper we present measurements of the non-linear variation of ferrite impendance in linear induction accelerator cells. Two cases are examined, a 250kV ATA cell and a 125kV ETAII cell. The ETAII cell, which resembles a ferrite loaded transmission line, is shown to have much less impedance variation than an ATA cell. Curves of ferrite impedance versus volt-seconds are presented

so trade offs between flux utilization and compensation can be evaluated. 4 refs., 6 figs.

49392 **(UCRL—97989) Design and testing of the 5 kHz, 3 MW thyratron modulators for ETA [Experimental Test Accelerator] II.** Newton, M.A.; Birx, D.L.; Ollis, C.W.; Reginato, L.L.; Smith, M.E.; Watson, J.A. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 3p. (CONF-880699—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014150/JAW.

From 18. power modulator symposium; Hilton Head, SC, USA (20 Jun 1988).

The Experimental Test Accelerator (ETA) II is a new, high-average- power, linear induction accelerator built at Lawrence Livermore National Laboratory to support Free-Electron-Lasers (FEL), research. ETA-II will also be used as a source of high-power microwaves for plasma heating experiments on the Microwave Tokamak Experiment (MTX). It can generate 1--3-kA, 70-ns electron beam pulses and accelerate them to 7--9-MeV. ETA-II is different from other linear induction accelerators in that it will have the ability to generate the electron beam at a 5 kHz repetition rate for 30-sec. Magnetic pulse compression and high-power thyratron modulators are used to generate the 125-kV accelerator drive pulses. This paper describes the design of the thyratron modulators, results of thyratron testing, and operation of the ETA-II system. 3 refs., 6 figs., 3 tabs.

49393 **(UCRL—98699) Recent advances in magnetically driven induction linacs.** Reginato, L.L.; Birx, D.L. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 4p. (CONF-880695—49). NTIS, PC A02. Order Number DE88014801/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

Increased interest in high-current, short-pulse electron beams for a wide variety of applications, including free-electron lasers, has generated a demand for high-performance, high-reliability induction accelerators. Advances in this technology will be reviewed. Designing the drive pulse sources is particularly challenging because the sources must deliver multi-gigawatt pulses with rise times of a few nanoseconds and pulse lengths of a few tens of nanoseconds. Recent developments in all-solid-state nonlinear magnetic drivers will also be discussed. 5 figs.

49394 **(UCRL—99308) PEGASYS—A proposed internal target facility for the PEP storage ring.** Van Biber, K. (Lawrence Livermore National Lab., CA (USA)). Jul 1988. Contract W-7405-ENG-48. 12p. (CONF-8805140—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015442/JAW.

From International conference on medium- and high-energy nuclear physics; Taipei, Taiwan (23 May 1988).

A proposal for an integral gas-jet target and forward spectrometer for the PEP storage ring is described. The beam structure, allowable, luminosity (L = 10^{33} cm/sup {minus}2/s/sup {minus}1/ for H_2, D_2) and energy (E/sub e/ ≦ 15 GeV) make the ring ideal for multiparticle coincidence studies in the scaling regime, and where perturbative QCD may be an apt description of some exclusive and semi-inclusive reactions. 14 refs., 7 figs.

4304 Storage Rings

REFER ALSO TO CITATION(S) 49274, 49367, 49438, 49887

49395 **(DESY-HERA—87-19) Simulation of background from proton losses in the HERA straight sections.** Brinkmann, R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1987. 25p. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.).

Using the GEANT computer code, the proton-induced background for the HERA experiments is investigated. A realistic geometrical setup including all magnetic elements and fields of the p-beam line is used. It is shown that the flux of particles from the tunnel can be drastically reduced with a relatively small amount of additional screening material surrounding the beam pipe at selected positions.

49396 **(LA-UR—88-1797) Strawman 1.6 GeV compressor design.** Colton, E.P. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 18p. (CONF-880263—8). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014465/JAW.

From Accelerator design workshop; Los Alamos, NM, USA (22 Feb 1988).

There is some local interest for a 1.6-GeV compressor ring which will deliver nominally 1 MW of beam power at {le}24 Hz. The 1.6-GeV kinetic energy would be obtained from an add-on linac to LAMPF. The flux requirement is 1.55 {times} 10{sup 14} ppp at 24 Hz. This can be met by using two stacked rings which are fed with two macropulses from LAMPF; the present H{sup {minus}} source must be upgraded. There are two constraints which must be met: The slow losses which occur in the Los Alamos Proton Storage Ring (PSR) cannot take place in these rings. It may be necessary to store beam in one of these rings for up to 8 msec so the rings must be stable against coherent instability. In view of these requirements, a Strawman compressor design is discussed.

49397 **(LA-UR—88-2076) Design of a main ring cavity.** Swain, G.R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 17p. (CONF-880263—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014418/JAW.

From Accelerator design workshop; Los Alamos, NM, USA (22 Feb 1988).

The design of a main ring rf cavity discussed here is part of a Los Alamos-TRIUMF collaboration. Out of three of the recent proposals for advanced hadron facilities (the Los Alamos AHF, TRIUMF KAON, and the European Hadron Facility proposals), the rf cavity requirements for the TRIUMF proposed Driver ring are the most severe. We attempt to meet as many of the TRIUMF requirements as possible in a preliminary cavity version that could be tested in the Los Alamos Proton Storage Ring (PSR) with a coasting beam. 8 refs., 14 figs.

49398 **(SLAC-PEP-NOTE—124) High performance magnet power supply optimization.** Jackson, L.T. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). [1988]. Contract AC03-76SF00515. 5p. (PEP—124). NTIS, PC A02. Order Number DE88014680/JAW.

The power supply system for the joint LBL–SLAC proposed accelerator PEP provides the opportunity to take a fresh look at the current techniques employed for controlling large amounts of dc power and the possibility of using a new one. A basic requirement of +- 100 ppM regulation is placed on the guide field of the bending magnets and quadrupoles placed around the 2200 meter circumference of the accelerator. The optimization questions to be answered by this paper are threefold: Can a firing circuit be designed to reduce the combined effects of the harmonics and line voltage combined effects of the harmonics and line voltage unbalance to less than 100 ppM in the magnet field. Given the ambiguity of the previous statement, is the addition of a transistor bank to a nominal SCR controlled system the way to go or should one opt for an SCR chopper system running at 1 KHz where multiple supplies are fed from one large dc bus and the cost--performance evaluation of the three possible systems.

49399 **(SLAC-PEP-NOTE—150) Study of a multi-hadron facility for 'PEP' based on toroidal field magnets.** Spillantini, P. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 1974. Contract AC03-76SF00515. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014840/JAW.

A facility based on magnetic fields with toroidal structure is proposed for the study of the e^+e/sup {minus}/ annihilation into multi-hadrons. Evaluations are carried out for a scheme with three toroidal superconducting coils (the 'central' coil and two 'small θ' coils) covering a 96%*4π solid angle. Very forward angles are kept free for the possible addition of two other toroidal coils covering down to {approximately}0.7{degree}. The choice of the geometrical dimensions of the 'central' and 'small θ' coils is discussed. The evaluations are made for two different geometries of the central

coil, one 'large' and the other one 'compact'. The weight of the coils is very low (.3--1.5t) while a {approximately}2.5 Tesla maximum field can be obtained ({approximately}3.5 Tesla for the 'compact' central coil). A complete detection apparatus requires for the central coil ('large' version) about 600 drift wires, 1000 proportional wires, 150 photomultipliers, 40 TOF channels; from another proposal the cost of a 'MPWC+ lead glass TAC' γ-detection system can be scaled to $650K or $1100K, depending on the possible inclusion of a high pressure gas cerenkov in the apparatus. Each 'small θ' spectrometer requires {approximately}1/4 of all this. The 'compact' coil reduces the cost for the central spectrometer by a factor of 1.5--2.

49400 (TRI-PP—88-45) Parallel bias vs perpendicular bias of a ferrite tuned cavity for the TRIUMF Kaon Factory booster ring. Poirier, R.L.; Enegren, T.A.; Enchevich, I.; Mai, S.J. (TRIUMF, Vancouver, British Columbia (Canada)). Jun 1988. 3p. (CONF-880695—31). NTIS (US Sales Only), PC A02; 1; GPO Dep. Order Number DE88013276/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

The RF cavity reference design from the Kaon Factory booster rings is a double gap drift-tube cavity with parallel biased ferrite tuners to vary the frequency from 46 MHz to 62 MHz. LAMPF has developed a single gap cavity with perpendicularly biased ferrite to vary the frequency from 50 MHz to 60 MHz. Measurements on the LAMPF cavity have indicated that their frequency range could be extended to cover our requirements while still maintaining a reasonable magnetic Q. The analysis and comparison of the RF circuit and the AC magnetizing circuit for both designs are reported. 14 refs., 6 figs.

44 INSTRUMENTATION

49401 (ORNL/TM—10846) Maintenance management department operational safety requirements program. Blanton, J.D.; Millet, A.J. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015379/JAW.

This document describes the requirements, precedures, and responsibilities of the I & C Maintenance Management Department for instrument maintenance in nonreactor nuclear facilities at the Oak Ridge National Laboratory that have Operational Safety Requirements. Applicable DOE, Martin Marietta Energy Systems, Inc., and ORNL procedures are outlined. The objective of this document is to present a surveillance plan for nonreactor nuclear facility safety hardware, thereby fulfilling the requirements of the responsible operating division. Scheduled maintenance and surveillance plans for components or systems as required by the ORNL Facility Operational Safety Requirements are also addressed. 6 ref.

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 48030, 48194, 48311, 49116, 49196, 49220, 49389, 49862, 49872, 49888, 49944, 50005, 50168, 50169, 50178, 50203

49402 (AAEC/E—654) Absolute determination of activity by the efficiency extrapolation method. Sherlock, S.L. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Apr 1987. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703947/JAW.

As agent for the Commonwealth Scientific and Industrial Research Organisation, the Australian Atomic Energy Commission is responsible for the maintenance of the Australian standard of activity. The standard comprises activity measurement procedures involving the operation of 4 π β-γ coincidence counting equipment. The coincidence method requires the application of correction factors which depend on detection efficiency, such as arise for complex decay schemes and internal conversion. These corrections approach unity as the detection efficiency in the β-channel approaches 100 per cent. By performing activity determinations for a range of β detection efficiencies, an 'efficiency extrapolation' analysis can be applied which eliminates the need to determine the absolute detection efficiency for each channel.

49403 (AD-A—193192/2/XAB) Radiometry using thermal images. Part 2. Technical details. Technical report. Oermann, R.J. (Electronics Research Lab., Adelaide (Australia)). Sep 1987. 25p. (ERL—0428-TR). NTIS, PC A03/MF A01.

In the first part of this report, the general operating procedures and system description of the AGA Model 782 Thermovision were outlined. The calibration of the system to determine the relationship between the Thermal value (an empirical quantity related to the energy received) and temperature was described in detail. To enable the radiometric use of these thermal imagers, characteristics such as Field of View, Spectral Response and Irradiance Sensitivity had to be measured in order to validate the manufacturers's supplied specifications. The increased emphasis on the need to enhance the digitized images using image-processing techniques has demanded the precise measurement of both the horizontal and vertical Modulation Transfer Functions in order to ascertain optimum sampling rates in both dimensions. This report will describe the techniques used to measure each of the necessary performance characteristics, detail all performance specifications of the Short Waveband (SWB) and Long Waveband (LWB) Model 782 Thermovisions in use in IOC Group in all hardware configurations and describe the optical path, scanning principle, and video format produced by the systems.

49404 (CBPF-NF—067/87) Range energy for heavy ions in CR-39. Gil, L.R.; Marques, A. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703961/JAW.

Range-energy relations in CR-39, for ions from He to Ar, are obtained after their effective nuclear charge. Comparison with earlier calculations and numerical results in the energy range 0,1 to 200 Mev/ Nucleon are also given. (M.W.O.).

49405 (CERN-EP—87-187) Test of a BaF_2-TMAE [tetrakis(dimethylamine)ethylene] detector for positron-emission tomography. Mine, P.; Charpak, G.; Santiard, J.C.; Scigocki, D.; Suffert, M.; Tavernier, S. (European Organization for Nuclear Research, Geneva (Switzerland); Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Inter-University Inst. for High Energies, Brussels (Belgium)). 1 Oct 1987. 20p. (CONF-8706311—1). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012601/JAW.

From Symposium on wire chambers in medical imaging; Corsendonk, Belgium (28 Jun 1987).

A detector consisting of BaF_2 scintillators and wire chambers has been tested for 511 keV gamma-rays. The wire chamber is filled with photosensitive tetrakis(dimethylamine)ethylene (TMAE) vapour and is operated at a pressure of a few Torr, using different gases at various temperatures. Energy, time, and position resolutions are given for BaF_2 crystals with sections of 10 x 10 mm^2 and 5 x 5 mm^2. We discuss the potential of this gamma detector for positron-emission tomography (PET) and compare it with other systems. 13 refs., 13 figs.

49406 (CONF-880557—4) A stochastic method for nuclear power plant diagnosis. Perez, R.B.; Wood, R.T. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015558/JAW.

From NATO advanced research workshop on noise and nonlinear phenomena in nuclear systems; Valencia, Spain (23 May 1988).

The value of using neutron noise descriptors, especially the power spectral densities (PSDs) of ex-core detectors, to monitor core barrel motion and fuel element vibrations in pressurized water reactors (PWRs) is well established. Indeed, in the mid-frequency range (1 to 20 Hz), PWR neutron noise is dominated by vibration peaks in the neutron PSD that result from the motion of reactor internals. A qualitative examination of such descriptors from a 1150 MWE Westinghouse PWR plant, re-examination of such descriptors from a 1150 MWE Westinghouse PWR plant, revealed significant changes in the plant's noise signature (PSD) as its first fuel

cycle proceeded. The purpose of this work is to use a mathematical model of the interaction between small mechanical motions and the core neutronics to provide a tool for quantitative investigation of the PSD structure in the vibrational frequency range. The purpose of neutron noise analysis is to provide information on plant conditions by the study of power traces from ex-core detectors. Due to the action of the coolant flow through the core and pump induced vibrations, the core barrel, which is bolted at the top of the reactor vessel, performs a pendular motion with a natural frequency determined by the mechanical parameters and constraints of the system. In addition, external forces deform the cylindrical shape of the core barrel by inducing vibrational modes which are excited by the turbulence of the coolant flow and by the {open←quotes}table-shaker{close←quotes} effect of the core barrel motion. As a result of the various mechanical motions, the detector response will vary in a manner próportional to the importance function at the location of the disturbance. 7 refs., 4 figs., 1 tab.

49407 (DOE/ER/03130—1) Closing the gap: Forward detectors for the SSC [Superconducting Supercollider]. Partridge, R. (Brown Univ., Providence, RI (USA). Dept. of Physics). 1987. Contract AC02-76ER03130. 6p. (CONF-870739—19). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012758/JAW.

From Workshop on experiments, detectors, and experimental areas for the supercollider; Berkeley, CA, USA (7 Jul 1987).

Forward detectors are likely to be part of any general purpose detector designed to study high-p{sub T} process at the SSC. The physics requirements and detector environment faced by forward detectors and their impact on detector design are examined.

49408 (DOE/ER/40039—22) Neutron induced pulses in CDF forward gas calorimeter. Cihangir, S.; Atac, M.; Cao, H.; DiBitonto, D.; Franke, H.; Funayama, Y.; Fukui, Y.; Hessing, T.; Kamon, T.; McIntyre, P.; Meyer, T.; Sampson, W.M.; Thane, J.M.; Webb, R.C.; Zamble, F. (Texas A and M Univ., College Station (USA); Fermi National Accelerator Lab., Batavia, IL (USA); KEK, Oho-machi, Ibaraki-ken (Japan)). 1988. Contract AS05-81ER40039. 5p. (CONF-881103—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number TI88011176/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

We studied and investigated the origin of the pulse due to large energy deposition in single pads of single layers at the CDF forward gas calorimeter. Results are consistent with the hypothesis that these pulse are created by protons in the calorimeter's chamber structure which are scattered by slow moving neutrons generated by hadronic showers. We present the characteristics of these pulses and calculate cross sections of their production at the CDF forward hadron calorimeter using the data from the 1987 p{ovr←string}p collider and 1988 test beam runs of the CDF, and the test we conducted with a neutron source. 2 figs.

49409 (DOE/ER/40135—2) Construction of a BGO Sum-Energy/Multiplicity Spectrometer and Multi-Compton-Suppression Spectrometer System for use at ATLAS: Final progress report for the period January 1, 1984--June 30, 1988. Garg, U. (Notre Dame Univ., IN (USA)). Jun 1988. Contract AC02-84ER40135. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014622/JAW.

A state-of-the-art gamma-ray facility has been constructed for use at the ATLAS facility of the Argonne National Laboratory. It consists of a 50-element central BGO Sum-Energy/Multiplicity Spectrometer surrounded by 12 high purity. Compton-suppressed Ge Spectrometers. A number of electronics modules needed for an efficient use of the facility have also been designed and constructed. The full device is now operational and meets or exceeds all its design specifications.

49410 (DOE/ER/40310—2) Photon detector for MEGA: Progress report, July 15, 1987-July 15, 1988. Gagliardi, C.A.; Tribble, R.E. (Texas A and M Univ., College Station (USA)). 1988. Contract FG05-87ER40310. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014725/JAW.

Last October and November, we had prototype runs at LAMPF to test our designs and to confirm the background and trigger rates predicted by our Monte Carlo studies. Since these two runs, our hardware efforts have been directed toward beginning mass production of the detector elements. In parallel, we have been continuing our pattern recognition efforts, pointing toward the goal of having subroutines ready for the intelligent, second-stage trigger by this coming fall. During October, our group carried out an experiment on a prototype detector in the LAMPF Test Channel which allowed us to study the performance of our scintillators, light guides, phototubes, and electronics in a well-controlled environment. This was followed in November by the first major prototype run inside the MEGA solenoid at the LAMPF Stopped Muon Channel (SMC). For this run, we fabricated a plane of 12 scintillators, each 1 x 5 x 180 cm^3, together with Al and lucite sheets whose thicknesses were chosen to reproduce the mass and radiation lengths that will be present in the real photon detector.

49411 (EGG—10282-2136) Pulse filtering techniques for mercuric iodide gamma ray detectors. Gerrish, V.M.; Beyerle, A.G. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). 1987. Contract AC08-83NV10282. 35p. (CONF-8709315—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014953/JAW.

From 6. international workshop on compound semiconductors for room temperature X-ray and nuclear detectors; Davos, Switzerland (14 Sep 1987).

Mercuric iodide detectors of 1 mm to 1 cm thickness exhibit high gamma ray efficiency but are limited by poor hole transport properties which degrade detector performance. Low hole mobility and hole trapping prevent complete charge collection. This results in less than optimum energy resolution when conventional Gaussian pulse shaping is applied. Alternative pulse filtering techniques have been investigated and significant improvements in the spectral response of these detectors have been demonstrated. These various approaches are discussed and results with mercuric iodide detectors are presented.

49412 (EGG—10282-2137) Developments in mercuric iodide gamma ray imaging. Patt, B.E.; Beyerle, A.G.; Dolin, R.C.; Ortale, C. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). 1987. Contract AC08-83NV10282. 24p. (CONF-8709315—5). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88014979/JAW.

From 6. international workshop on compound semiconductors for room temperature X-ray and nuclear detectors; Davos, Switzerland (14 Sep 1987).

A mercuric iodide gamma-ray imaging array and camera system previously described has been characterized for spatial and energy resolution. Based on this data a new camera is being developed to more fully exploit the potential of the array. Characterization results and design criterion for the new camera will be presented. 2 refs., 7 figs.

49413 (EGG—10282-2138) Comparison of transparent conducting electrodes on mercuric iodide photocells. Cheng, A.Y.; Markakis, J.M. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). 1987. Contract AC08-83NV10282. 17p. (CONF-8709315—6). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014980/JAW.

From 6. international workshop on compound semiconductors for room temperature X-ray and nuclear detectors; Davos, Switzerland (14 Sep 1987).

Three materials have been developed and tested which are suitable as transparent conducting electrodes on mercuric iodide; aqueous ionic contacts of NAC{ell} and LiC{ell}, polyvinyl alcohol/phosphoric acid, and indium--tin--oxide (ITO). Polyvinyl alcohol/phosphoric acid is a conducting polymer and ITO is a wide band gap semiconductor. Photocell dimensions were in the range of 0.5 to 3.8 cm diam by about 1 mm thick. Photocells with these electrodes were evaluated for their spectral response in the range of 300 to 650 nm, response uniformity over the electrode activities area, leakage current and reliability. All units showed better than

75% quantum efficiency in the range 350 to 550 nm. Photodetector leakage currents ranged from 25 to 200 pA and have shown long term stability up to 1 year.

49414 **(EGG—10282-2146) Characterization of HgI_2 single crystals and detectors by x-ray rocking curve analysis and x-ray reflection topography.** Ostrom, R.; Keller, L.; Wagner, N.J.; Schieber, M.M.; Ortale, C.; van den Berg, L.; Schnepple, W.F. (California Univ., Los Angeles (USA). Dept. of Materials Science and Engineering; EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). 1987. Contract AC08-83NV10282. 53p. (CONF-8709315—9). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88014958/JAW.

From 6. international workshop on compound semiconductors for room temperature X-ray and nuclear detectors; Davos, Switzerland (14 Sep 1987).

An attempt has been made to establish a correlation between the results of x-ray rocking curves and x-ray reflection topographs for vapor grown HgI_2 single crystals. X-ray rocking curves were obtained by double crystal spectroscopy with Si as the first crystal and topographs were produced using the Berg-Barrett technique with an asymmetrically cut Si-disperser. The crystals were evaluated at different stages of detector preparation, i.e., cutting, polishing, etching, and deposition of contact. Multiple diffraction peaks could be observed as being indicative of small angle grain boundaries of up to 2{degree}. Definite nonuniformities on virgin single crystals as well as on detector crystals were observed by both methods. The crystal surface quality as assessed by these methods were used as a criterion to verify detector performance rating. No drastic improvement of surface quality on space grown crystals was indicated by these techniques. Efforts have also been devoted to determine intrinsic full width at half maximum of HgI_2 crystal for the crystallographic direction studied. 16 refs., 22 figs.

49415 **(EGG—10282-2162) Optical detection of impurities and defects in detector-grade mercuric iodide.** James, R.B.; Ottesen, D.K.; Wong, D.; Schlesinger, T.E.; Schnepple, W.F.; Ortale, C.; van den Berg, L. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). 1987. Contract AC08-83NV10282. 32p. (CONF-8709315—10). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014959/JAW.

From 6. international workshop on compound semiconductors for room temperature X-ray and nuclear detectors; Davos, Switzerland (14 Sep 1987).

Fourier tranform infrared spectroscopy (FTIR) and low-temperature photoluminescence were used to study impurities and defects in mercuric iodide crystals. FTIR spectra of the transmittance and reflectance were obtained in the 400 to 4000 cm/sup {minus}1/ range, and the results were found to vary for different samples due to the presence of impurities and stoichiometry deviations. The photoluminescence data were found to consist primarily of three distinct emission bands. The lowest energy band at about 680 nm (at 4.2 K) was shown to be related to the performance of nuclear radiation detectors fabricated from these samples. Further correlations between the spectral features obtained from FTIR and photoluminescence techniques and the detector response are also noted.

49416 **(EGG—10282-2164) Rutherford Backsattering and Auger spectroscopy of mercuric iodide detectors.** Felter, T. E.; Stulen, R. H.; Schnepple, W. F.; Ortale, C.; van den Berg, L. (Sandia National Labs., Livermore, CA (USA); EG and G, Inc., Goleta, CA (USA). Santa Barbara Operations). 1987. Contract AC08-83NV10282. 15p. (CONF-8709315—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014973/JAW.

From 6. international workshop on compound semiconductors for room temperature X-ray and nuclear detectors; Davos, Switzerland (14 Sep 1987).

The electrical properties of metallic contacts on solid state x-ray detectors can play an important role in determining the overall response and sensitivity of these devices. Rutherford Backscattering (RBS) and Auger electron spectroscopies have been utilized to characterize thin palladium contacts on mercuric iodide (HgI_2) detectors. The RBS measurements were performed at room temperature with the metal contact preventing evaporate loss of the HgI_2 and reducing contamination to the vacuum chamber. Computer simulations of the RBS results indicate that the interface region of a sample with a palladium contact had approximately the ideal stoichiometry but that the palladium film thickness (350 {angstrom}) was less than expected from the deposition conditions. Auger sputter profiling which removes the metal contact "cap" was performed with a rapid transfer system equipped with liquid nitrogen cooling to avoid evaporative loss of the sample and reduce vacuum system contamination. This technique indicated significant penetration of Hg and I into the Pd contact for a variety of samples. In many cases, the penetration extended all the way to the surface. For a 600 {angstrom} contact, approximately two thirds or 400 {angstrom} of the contact is part of a "reaction zone" in which there is strong intermixing of the palladium, mercury, and iodine. In one case, where copper was tried as an electrode, the "reaction zone" extended all the way to the surface, and the device failed as a detector. The relationship of the contact stoichiometry to the deposition process and device performance will be discussed. 5 refs., 4 figs.

49417 (INIS-BR—1147-Vol., pp 87-99) **Qualitative and quantitative analysis of reconstructed images using projections with noises.** Lopes, R.T.; Assis, J.T. de. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The reconstruction of a two-dimencional image from one-dimensional projections in an analytic algorithm "convolution method" is simulated on a microcomputer. In this work it was analysed the effects caused in the reconstructed image in function of the number of projections and noise level added to the projection data. Qualitative and quantitative (distortion and image noise) comparison were done with the original image and the reconstructed images.

49418 (INIS-BR—1147-Vol.1, pp 221-230) **Fast neutron spectrometry using NE.213 scintillator.** Coelho, P.R.P.; Maiorino, J.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

This work describes a fast newtron spectrometer using a liquid scintillator, NE-213, installed at IPEN-CNEN-SP. The Neutron-Gamma discrimination is made using a pulse-shape discrimination technique. A neutron energy spectra for Am-Be source is shown. The result agree with others presented by others authors. The measured proton-recoil pulse height spectra was unfolded in neutron energy spectra by using FANTI unfolding code.

49419 (INIS-BR—1147-Vol.2, pp 191-198) **Automation of a thermoluminescent individual monitoring service.** Mauricio, C.L.P.; Becker, P.H.B. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A data acquisition and treatment system has been developed for thermoluminescent readers. The project included both the hardware and the software of the system. Individual neutron monitoring, due to its higher complexity and need of better accuracy, is the main application for this system. Furthermore such automation allows quicker evaluation, with smaller errors and better quality control of IRD's Thermoluminescent Individual Monitoring Service.

49420 (INIS-BR—1147-Vol.2, pp 115-121) **Kit with track detectors aiming at didactic.** Cesar, M.F.; Koskinas, M.F. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The kit intends to improve the possibilities in performing experiments of Nuclear Physics in Modern Physics Laboratories of Physics Course introducing the solid state nuclear track detectors. In these materials the passage of heavily ionizing nuclear particles creates paths (tracks) that may be revealed and made visible in an optical microscope. By the help of the kit several experiments and/or demonstrations may be performed. The kit contains solid state nuclear track detectors unirradiated and irradiated, irradiated etched and uneteched sheets; an alpha source of /sup 241/Am and an instrution text with photomicrographs. To use the kit the laboratory must have an ordinary optical microscope.

49421 (INIS-BR—1147-Vol.2, pp 199-206) **Utilization of photodiodes for ionizing radiation dosimetry.** Khoury, H.J.; Melo, F.A. de; Lira, C.A.B.O. (Pernambuco Univ., Recife (Brazil). Dept. de Energia Nuclear). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The behaviour of silicon photodiodes as detector, for gama and x-ray dosimetry is discussed. Measurements were realized with photodiodes operating in the photovoltaic mode, the current produzed was detected in the eletrometer constructed in the DEN/UFPE. The results obtained showed that the photodiode response is linear with the dose and that variation of 40 degrees in the incidence angule of the radiation caused a variation of 5% in the dose determination.

49422 (INIS-BR—1147-Vol.2, pp 405-414) **Utilization of low energy photon detectors for determining rare earths in rocks.** Figueiredo, A.M.G. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Neutron activation analysis followed by gamma ray spectrometry using Ge(Li) detectors has been used for many years in the Radiochemistry Division of IPEN for the determination of rare earth elements (REE) in rocks. More recently, an hyperpure Ge detector (low energy photon detector) has been used also,since it is particularly suited to resolve the complex low energy region of the gamma spectra of neutron irradiated rocks. Elements like Ce, Nd, Sm and Yb are more precisely determined using Ge detectors. In the present work, the advantages of using Ge detectors for the determination of REE in rocks are discussed and some results obtained for the French geological standard GS-N are presented.

49423 (INIS-BR—1147-Vol.3, pp 157-167) **Maintenance of nuclear instruments.** Oliveira Rebelo, A.M. de; Santos, C.J.F. dos; Jesus, E.F.O. de; Silva, L.E.M.C.; Borges, J.C. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A program to design and repairing of nuclear instruments for teaching and research was founded in the UFRJ to find solutions for technical support problem - The GEMD-RADIACOES. This group has assisted to several groups of the University in recuperation and conservation of devices like: Linear scanner, Cromatograph and system of radiation detection in general. Recuperation of these devices had required a study of theirs operations modes, to make it possible the setting up of a similar system. Recuperation also involves operation tests, calibration and technical for users, orienting them to get the best performance.

49424 (INIS-BR—1147-Vol.3, pp 117-120) **Application of plastic scintillators with light intensifiers in photographic dosemeters to increase the sensitivity.** Mesquita, C.H. de; Hamada, M.M. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The purpose of this work is to evaluate the effect of a light converter (plastic scintillator) to use as badge in the conventional photographic dosimeter. In this dosimeter the light is a new component of emulsion sensibilization. So, even radiations that are not able to reach the photographic emulsion can be detected by producing photons in the plastic scintillator.

49425 (INIS-BR—1147-Vol.3, pp 3-10) **Angular dependence of dosimetric films for gamma radiation.** Barbosa, M.V.; Sanches, M.P. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

In most situations, radiations workers are subjected to radiation exposures at randon angles of incidence. Consequentetly, the personnel dose estimates would be lower since calibration is usually accomplished with stationary films positioned perpendicular to beam on radiation, i.e., at normal incidence. In oder to obtain an error estimate due to angular dependence the radiation incidence angle related to badges having Agfa Gevaert Struturix D/sub 2/ and D/sub 10/ (commonly used in individual dosimeter) was variated between 0 and 90/sup 0/.

49426 (INIS-BR—1147-Vol.3, pp 31-39) **FIND - a computer program for peak search in gamma-ray spectra measured with Ge (Li) detectors.** Venturini, L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The program FIND is a FORTRAN IV computer code for peak search in spectra measured with Ge(Li) detectors. The program gives the position and estimates energy and relative significance for every peak found in the spectrum. The search in done by calculating a negative smoothed second difference of the experimental spectrum, as suggested by Phillips and Marlow (1).

49427 (INIS-BR—1147-Vol.3, pp 41-46) **Comparative study between ionization chambers with parallel plates.** Albuquerque, M.daP.P.; Batistella, M.A.; Caldas, L.V.E. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The main characteristics of an ionization chamber with parallel plates, constructed at IPEN, as reprodutibility, long term stability and energy dependence, were compared with those of commercial chambers of the same type, exposing them to standard fields of low energy X-radiation and beta radiation of /sup 90/Sr+/sup 90/Y.

49428 (INIS-BR—1147-Vol.3, pp 83-92) **Energy and angular dependence of beta radiation detectors.** Albuquerque, M.daP.P.; Xavier, M.; Caldas, L.V.E. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Using for comparisons the reference system for beta radiation detection, with mainly an extrapolation chamber and an electrometer, several types of monitoring instruments normaly used in

gamma radiation were studied in relation to their energy and angular dependence, when exposed to beta radiation. Portable instruments as Geiger-Muller type, pocket dosemters and cylindrical ionization chambers were tested. The instrument measurements were taken during their irradiation with /sup 90/Sr + /sup 90/Y, /sup 204/Tl and /sup 147/Pm sources.

49429 (INIS-BR—1147-Vol.3, pp 93-100) **Calibration of phoswich detectors for the "in vivo" measurement of uranium deposited in the lungs.** Lourenco, M.C.; Oliveira, C.A.N. de; Dantas, B.M.; Lucena, E.A. de. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The calibration of phoswich detectors for the "in vivo" measurement of uranium deposited in the lungs was performed using a tissue-equivalent thorax phantom, developed by the Lawrence Livermore National Laboratory (LLNL), which simulates a tissue composition of 50% fat and 50% muscle. Counts were performed during 60 minutes, with inert and natural uranium contaminated lungs, for five differents chest wall thicknesses. Efficiency and minimum detectable activity curves were plotted as functions of the thickness.

49430 (INIS-BR—1147-Vol.3, pp 393-402) **Programme in Basic-Applesoft language for microcomputer to analyse pulse spectra from a high-resolution gamma ray system.** Nascimento Filho, V.F. do; Marques, D.A.; Pessenda, L.C.R.; Barros Ferraz, E.S. de; Nadai, E.A. de. (Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil); Sao Paulo Univ., Piracicaba (Brazil). Escola Superior de Agricultura Luiz de Queiroz). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A programme in BASIC-Applesoft language has been developed for low cost microcomputer to analyze spectra from a high-resolution gamma-ray system (high-purity germanium and 4096 channels analyzer). Data is received by the microcomputer directly from analyzer (4 min) or keyboard and shown on video (4 min) or printed (9,7 min). Graphics of parts of the spectrum can be either shown on video (a cursor is used to identify peaks) or printed. The peak search, centroid, energy, net photopeak area, standard deviation and relative standard deviation are included in the programme (5 min), besides filing of data in flexible disk (1,3 min). The programme was used on a 12 h real-time detection in Marinelli beaker of 1265 g sandy soil sample (Ref-Yellow Latosol, 0-3 cm layer). Thirty-one peaks from U-238 and Th-232 daughters were analyzed (rsd less than 20%), besides natural K-40 and artificial Cs-137, from fallout.

49431 (N—88-22834) **External tank gamma ray imaging telescope study. Final review, phase 2.** (Martin Marietta Corp., Bethesda, MD (USA)). Feb 1988. 147p. (NASA-CR—179320; NAS—1.26:179320). NTIS, PC A07/MF A01.

Potential scientific uses of the external tanks were examined. An onorbit conversion of the external tank to a gamma ray telescope/spacecraft is feasible. The development time and cost are acceptable. The specific engineering research and development requirements are listed. Concepts for onorbit utilization of external tanks were developed. The tasks for phase three were summarized.

49432 (OEFZS—4446) **Isotope analysis of /sup 15/N - a comparison of methods.** Faust, H.; Blochberger, K.; Pichlmayer, F. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung; Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Landwirtschaft). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Apr 1988. 10p. (In German). (LA—197/88). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704057/JAW.

Recently the two-stage procedure of stable isotope analysis (measuring gas preparation with different chemical methods and MS-analysis) is replaced by an on line technique, which combines chemistry and isotope analysis in one step. The aim of this work was to compare several analytical methods for the /sup 15/N-determination and to give a preliminary estimation of their efficiencies. 6 tabs.

49433 (PB—88-217435/XAB) **NBS (National Bureau of Standards) measurement services: activation-foil irradiation by reactor-cavity fission sources. Special pub.** Lamaze, G.P.; Grundl, J.A. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). Mar 1988. 60p. (NBS/SP—250/14). NTIS, PC A04/MF A01.

Also available from Supt. of Docs.; Library of Congress catalog card no. 88-600513.

This document describes the National Bureau of Standards (NBS) calibration service 44090C (formerly 8.1R) which operates in the following way: (i) dosimetry sensors (metal foils, nuclear track detectors, wires, crystals, etc., supplied by the customer or by NBS) are irradiated to a measured neutron fluence in a fission-spectrum neutron field (for short lived reaction products, the samples are irradiated to near saturation and the fluence rate specified); and (ii) the irradiated dosimetry sensors are shipped to the customer, followed by a test report stating the fluences or fluence rates and associated uncertainties. The scope and philosophy of the service, the neutron-field characteristics, irradiation procedures, and the uncertainties in the reported neutron fluences or fluence rates are discussed. Typical maximum fluences are of the order of 3 x 10^{15} neutrons/sq cm, with combined (1 omega) uncertainties of + or - 2 %.

49434 (PB—88-217443/XAB) **Activation-foil irradiation with californium fission sources. Special pub.** Lamaze, G.P.; Grundl, J.A. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). Mar 1988. 42p. (NBS/SP—250/13). NTIS, PC A03/MF A01.

Also available from Supt. of Docs.; Library of Congress catalog card no. 88-600508.

This document describes the NBS calibration service 44080C (formerly 8.10), which operates in the following way: (i) dosimetry sensors (metal foils, nuclear track detectors, wires, crystals, etc., supplied by the customer or by NBS) are irradiated to a certified neutron fluence in a ^{252}Cf spontaneous fission neutron field (for short lived reaction products, the samples are irradiated to near saturation and the fluence rate specified), and (ii) the irradiated dosimetry sensors are shipped to the customer, followed by a test report stating the fluences or fluence rates and associated uncertainties. The scope and philosophy of the service, the neutron-field characteristics, irradiation procedures, and the uncertainties in the reported neutron fluences or fluence rates are discussed. Typical maximum fluences are of the order of 1 x 10^{13} neutrons/sq cm and maximum fluence rates of 10 million neutrons/cm$_2$ sec, with combined (1 sigma) uncertainties of + or - 1.2%.

49435 (PTB-Dos—11e) **Conversion factors for ICRU dose equivalent quantities for the calibration of radiation protection dosimeters.** Grosswendt, B.; Hohlfeld, K.; Kramer, H.M.; Selbach, H.J. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Dosimetrie der Photonen und Elektronen). Mar 1988. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754675/JAW.

Conversion factors from air kerma to ambient and directional dose equivalent have been published by several authors. These data have been critically examined and subjected to an averaging procedure weighting the data according to the stated uncertainties. The averaged conversion factors are presented and recommended for interim use until conversion factors will be internationally agreed upon. In a second part correction factors are presented for calibrating dosimeters in front of phantoms different in shape and material from the ICRU sphere.

49436 **(SAND—88-0231C) Comparison of measured responses in two spectrally-sensitive x-ray detectors to predictions obtained using the ITS [Integrated Tiger Series] radiation transport code.** Carlson, G.A.; Beutler, D.E.; Seager, K.D.; Knott, D.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 23p. (CONF-880730—9). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014846/JAW.

From 25. annual conference on nuclear and space radiation effects; Portland, OR, USA (12 Jul 1988).

Responses of a Ge detector and a filtered TLD array detector have been measured at a steady-state bremsstrahlung source (the Pelletron), at endpoint energies from 150 to 900 keV. Predictions of detector response using Monte Carlo ITS codes are found to be in excellent agreement with measured response for both detectors. These results extend the range of validity of the ITS codes. With calibration provided by these experiments and by ITS predictions, dose-depth data from the TLD arrays can be used to estimate flash x-ray source endpoint energies.

49437 **(SAND—88-2126C) High altitude balloons and gamma ray astronomy.** MacCallum, C.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 10p. (CONF-880788—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014525/JAW.

From 4. SDIO/IST pathways to space experimentation workshop; Orlando, FL, USA (12 Jul 1988).

The author's experience with scientific high altitude ballooning will be presented. Usefulness of satellite versus balloon platforms will be contrasted in the context of gamma ray astronomy. General principles of gamma ray astronomy instrumentation will be discussed and illustrated in terms of our current instrument, GRIS. Some words about the supernova phenomenon and its necessity for the existence of life in the universe will be followed by a brief glimpse of our preliminary data from Supernova 1987a.

49438 **(SLAC-PEP-NOTE—170) Two methods to measure the e{sup {plus+-minus}} polarization at PEP.** Camerini, U.; Cline, D.B.; Learned, J.G.; Mann, A.K.; Resvanis, L.K.; Wanderer, P.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 1988. Contract AC03-76SF00515. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015163/JAW.

Backward Compton scattering of circularly polarized photons from an e{sup {plus+-minus}} beam can be used to measure the polarization of that beam. We describe a simple, compact fast monitor that measures the beam polarization at P.E.P. by scattering a laser beam off the e{sup {plus+-minus}} bunches and detecting the backscattered photons. We also present graphs of how the {d{sigma}/d{Omega}}of the electromagnetic processes e{sup +}e{sup{minus}} {yields} e{sup +}e{sup{minus}}, {mu}{sup +}{mu}{sup{minus}}, {tau}{tau} is modified by the transverse polarization of the initial state particles.

49439 **(SLAC-PEP-NOTE—172) A first look at a polarimeter for EPIC or PEP.** Toner, W.T. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 1988. Contract AC03-76SF00515. 7p. (PEP—172). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015172/JAW.

A derivation of the resolution function is given in terms of machine parameters and detector resolution. A preliminary design is outlined for a pair spectrometer to detect high energy backscattered laser photons. A more careful examination is needed of the asymmetry as a function of resolution, of laser geometry and rates, and of problems associated with installing and using the system at PEP. 2 figs., 1 tab.

49440 **(UCRL—98207) Linear CCD with enhanced x-ray quantum efficiency.** Ables, E.; Bionta, R. (Lawrence Livermore National Lab., CA (USA)). 12 Jul 1988. Contract W-7405-ENG-48. 4p. (CONF-880887—2). NTIS, PC A02. Order Number DE88014176/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

We have built a linear CCD with enhanced quantum efficiency to x-rays. The primary objective is to replace an existing scanning pinhole camera used to evaluate x-rays optics that we are developing. The scanning pinhole camera can take up to 3 hours to acquire a single scan of data. Several scans may be required in order to evaluate an optics part. By using a linear CCD, an entire scan of data can be taken at the same time, which would reduce the data collection time for an optics part to a few minutes.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

49441 **(AD-A—193001/5/XAB) JFET/SOS (junction field-effect transistor/silicon-on-sapphire) devices: gamma-radiation-induced effects. Technical report.** Halle, L.F.; Zietlow, T.C.; Barnes, C.E. (Aerospace Corp., El Segundo, CA (USA). Electronics Research Lab.). 1 Mar 1988. 29p. (TR—0086(6925-07)-3). NTIS, PC A03/MF A01.

Enhancement and depletion mode JFETs have been fabricated on silicon-on-sapphire substrates. When these devices are irradiated under bias with a ^{60}Co source, their drain currents increase, and their threshold voltages shift in such a way that the devices become more difficult to pinch off. These effects can be explained by positive charge trapping at the silicon/sapphire interface. Gate to drain leakage currents also increase, and can be traced to interface effects at the gate edges rather than to the passivating oxide. These effects were studied as a function of dose rate and postirradiation annealing. Deep-level transient spectroscopy (DLTS) was performed prior to and following both irradiation and anneal on both the gate-drain and gate-source p-n junctions. DLTS trap bands were observed whose characteristics depended on the depth of the depletion layer and on the total gamma dose received. The DLTS spectra suggest that a continuum of levels is responsible for the bands, and that the emission kinetics are influenced by band bending at the Si/sapphire interface. The major bands corresponded in temperature with steps in capacitance-temperature curves. A correlation of these steps with the transistor characteristics suggests that channel pinch off can be influenced by capture and emission at deep centers.

49442 **(PB—88-210778/XAB) Multitier specification applied to modify the hardness of an essential NSEP (National Security/Emergency Preparedness) fiber optic link.** Peach, D.F.; Adair, R.T. (Department of Commerce, Boulder, CO (USA). Inst. for Telecommunication Sciences). Mar 1988. 156p. (NTIA—88-231). NTIS, PC A08/MF A01.

See also PB—87-210308.

The Mulitier Specification was developed to provide guidelines and recommendations for improving the durability of the communication installations necessary for National Security/Emergency Preparedness (NSEP). The application of the Multitier Specification is considered beyond the installation and engineering requirements of typical commercial fiber optic systems. Five levels of hardness are defined in the specification. A link that could be important (may be asked to provide service) to the operation of the U.S. Space Command/NORAD was chosen as a candidate for the analysis. Based on the time-critical nature of the telecommunication traffic carried on this link and the stress expected, the Level 4 (Maximum) hardness was chosen as the target level for upgrade of this link. The elements of the existing system are classified into levels using the Mulitier Specification. The report describes the enhancements necessary to mitigate the stress threat within the guidelines of the Mulitier Specification and to raise the level of hardness to Level 4 (Maximum). The cost associated with the installation of these enhancements is included. Solutions to problems peculiar to the path specified for the link are described in terms of one suggested alternative. Also, an estimate of the additional initial investment required to harden the system to Level 4 (Maximum) is included.

49443 **(SAND—88-0367C) Simulation fidelity issues in reactor irradiation of electronics:Reactor environments.** Kelly, J.G.; Luera, T.F.; Posey, L.D.; Williams, J.G. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 16p. (CONF-880756—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013003/JAW.

From IEEE-NSREC and SEU symposium; Portland, OR, USA (1 Jul 1988).

Fast burst reactors (FBRs), such as SPR III, and pool-type reactors, such as the University of Illinois TRIGA and the Sandia Annular Core Research Reactor, are used as sources of neutrons and/ or gamma rays in transient radiation effects in electronics (TREE) research and testing. Here we identify the important simulation fidelity issues, compare radiation environments produced in representative reactors, and describe custom environments that have been achieved to better meet experimenter requirements.

49444 **(UCRL—21056) Photographic documentation for AGT-87 Survivability of Coatings (SOC) Program.** Edwards, D.F.; Wirtenson, G.R. (Lawrence Livermore National Lab., CA (USA)). Apr 1988. Contract W-7405-ENG-48. 112p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88014166/JAW.

Microphotographs are given of the 19 coating designs tested in the 1987 Aboveground Test fielded at the Blackjack 5 facility operated by Maxwell Laboratories. Details of the coating preparation methods, test results, diagnostic and computational methods can be found elsewhere. 49 figs.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 48038, 49006, 49113, 49151, 49235, 49260, 49535, 50130, 50131, 50152, 50216

49445 **(AD-A—192928/0/XAB) Nuclear magnetic resonance spectrometer. Final report, 15 July 1986-15 July 1987.** Donahue, F.M. (Michigan Univ., Ann Arbor (USA). Dept. of Chemical Engineering). 1987. 2p. NTIS, PC A02/MF A01.

The major purpose of the spectrometer was to support research on low-temperature molten salts; specifically, to be used in the determination of the composition of the salt solutions (^{1}H and ^{13}C) and as a probe in the determination of the nature of complexation of metal complexes. In the case of the latter, the instrument was used to probe the nature of octahedral cationic complexes of aluminum and gallium in the melts (the first such observations). Some of the aluminum work has been in support of the work at the University of Michigan and some of the aluminum and all of the gallium work is collaboration with the F.J. Seiler Research Laboratory (AFSC) at the Air Force Academy.

49446 **(CERN-EP—87-193) Three-dimensional gaseous detectors.** Sauli, F. (European Organization for Nuclear Research, Geneva (Switzerland)). 9 Oct 1987. 20p. (CONF-8709153—6). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88013854/JAW.

From Conference on position-sensitive detectors; London, UK (7 Sep 1987).

The gaseous multiwire proportional chamber was developed as a fast electronic detector of ionizing radiation about twenty years ago. The basic device has been used in a large variety of designs and applications, mostly for the needs of elementary particle physics. Some of the detectors developed are truly three-dimensional, i.e., provide the space coordinates of tracks without ambiguities, even for rather complex patterns. In the present paper the author briefly summarizes the operating principles of such detectors and the latest advances in the field.

49447 **(CONF-880790—1) Extending the life of a Bausch and Lomb Research II metallograph.** Crouse, R.S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014741/JAW.

From 21. annual technical meeting of the International Metallographic Society; Toronto, Canada (26 Jul 1988).

The Bausch and Lomb Research II metallograph has been out of production for several years and objective lenses are becoming impossible to get. As lenses become damaged and unavailable, the usefulness of an otherwise fine instrument drops to zero. A successful attempt to retrofit Nikon lenses to a research II has been made. Mechanical modifications to the metallograph were easily accomplished by an experienced service man using the machine shop facilities available. The resulting modifications have restored the usefulness of our metallograph beyond expectations, and provided us with a viable means of maintaining it in sevice for many years to come.

49448 **(CONF-8809106—1) Selection of sensors for measurement and control.** Anderson, R.L.; Miller, G.N. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02. Order Number DE88012936/JAW.

From Sensors Expo; Chicago, IL, USA (13 Sep 1988).

The factors that must be considered in selecting sensors for measurement and control are outlined and discussed: parameters to be measured, range, allowable uncertainty, the medium in contact with the sensor, environment outside the sensor, desired output, tried-and-true vs state-of-the-art, reliability and lifetime requirements, cost tradeoffs, application-specific considerations, failure modes, response time, and other considerations. (DLC)

49449 **(CRIE-T—86090) Investigation on applicability of solid-gas flow meter to pulverized coal-fired boiler.** Nishio, Masato; Yamada, Tomoo. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). Sep 1987. 38p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88753438/JAW.

After the two oil shocks, demands of reducing discharge of NOx, etc. has ever become severer, while coal-fired boilers have been increasing. Concerning a coal-fired boiler, coal pulverized with a mill is transported by the air through several branched tubes per mill to each burner, but there is no well established industrial measuring instrument which measures a solid-gas two-phase flow of the pulverized coal and the air flowing through a tube. However, the above measurement of flow is necessary for low NOx combustion and equalization of heat loads of furnaces. There are several solid-gas two-phase flow meters, but as those which seem to be adaptable to the solid-gas two-phase flow of the pulverized coal and the air in the pulverized coal tube, the pneuma-line flow meter detecting differential pressure, the cross-correlation flow meter and the powder flow meter using microwaves are considered. But as a result of the examination, none of them was appropriate. Nevertheless, the equalization of the amount of the pulverized coal and the amount of the air flowing in each pulverized coal tube is important, therefore it is enough to install in each tube two detectors, each of which detects separately either the former amount or the latter amount and to compare the two detection signals. A study along this line is required. (23 figs, 7 tabs, 54 refs)

49450 **(DP-MS—86-44) Overview of density meters used at SRP for sample validation.** Maxwell, S.L. III. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1986. Contract AC09-76SR00001. 8p. (CONF-860654—51). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014300/JAW.

From 27. annual meeting of the Institute of Nuclear Materials Management; New Orleans, LA, USA (22 Jun 1986).

For the process control laboratory, the verification of sample integrity prior to analysis is a critical prerequisite for reliable analytical measurements. At the Savannah River Plant (SRP), density check systems are employed to verify that samples are representative of respective process tank solutions. A wide array of Mettler density meters is used. With respect to temperature control, water-bath thermostatted, electronically thermostatted, and temperature-corrected density meters have proven useful. Also, density meters with measurements precise to four, five, and six decimal places are required to meet overall sample validation needs. Remote density cells are used to facilitate density measurements in radiobenches, glove boxes and shielded cells. The selection of a density meter system for a specific sample validation application depends on numerous factors including: precision required; type of containment; radiation levels; exposure to corrosive chemicals; and range of density measurements required. Temperature-corrected density meters have proven very useful for achieving measurements precise to five decimal places under conditions where the use of water baths is not safe, and the use of sensitive electronic components is not practical. Computer software is used to correct for ambient temperature changes in the density measuring cell. An auto-

mated six-place density meter is now in use for validating dilute uranium product samples. Customized software is used to determine the error of density measurements as well as sampling error.

49451 (INIS-BR—1147-Vol.2, pp 207-215) **Scaler/timer for nuclear instrumentation with microprocessor.** Elbern, A.W.; Laan, F.T. van der. (Rio Grande do Sul Univ., Porto Alegre (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A Scaler/Timer was developed with programming facilities through a small Keyboard, controlled by the 6502 microprocessor. This equipment is for the use in nuclear instrumentation, teaching or research. The emphasis in our design, was on a reliable versatil and low cost equipment. Also, the equipment allows two modes of operation, i.e. a SCALER and a TIMER mode, both with the possibily of data acquisition in pre-programmed time intervals beside this options, data can be printed with a paralel printer or transmited to a microcomputer.

49452 (K/ETAC—52) **Remote high-temperature thermometry of rotating test blades using YVO_4:Eu and Y_2O_3:Eu thermographic phosphors.** Tobin, K.W.; Allison, S.W.; Cates, M.R.; Capps, G.J.; Beshears, D.L.; Cyr, M. (Oak Ridge National Lab., TN (USA); Pratt and Whitney Aircraft, East Hartford, CT (USA)). 1988. Contract AC05-84OT21400;AC05-84OR21400. 8p. (CONF-880764—2). NTIS, PC A02. Order Number DE88013111/JAW.

From 24. AIAA/ASME/SAE/ASEE joint propulsion conference; Boston, MA, USA (11 Jul 1988).

Remote temperature sensing using thermal phosphors is being developed as a nonintrusive technique for monitoring and analyzing the high-temperature, highly corrosive environments of turbomachinery. Proof-of-principle tests were conducted on phosphor-coated turbine blades which were rotating at low speeds and were immersed in a jet fuel flame. A pulsed nitrogen laser produced fluorescence from the applied phosphor. A simple optical scheme collected this emission, and a digital oscilloscope extracted from the signal the temperature-dependent decay rate. Measured temperatures ranged from 700-1000{degree}C. These were comparable with values indicated by a pyrometer. Time-dependent temperature measurements demonstrated the transient capabilities of the thermophosphor technique. This is only the second time the phosphor technique has been implemented in a flame environment. The previous work involved a water-cooled object near 150{degree}C. The current test was at a much higher temperature and incorporated a rotating object as well. The data provide important information for designing a thermophosphor system for future real-engine testing. 8 refs., 9 figs., 2 tabs.

49453 (K/ETAC—59) **Phosphor bonding studies---burner-rig endurance test.** Beshears, D.L.; Henson, H.M.; Henson, T.J.; Bridges, M.J.; Sadler, R.M.; Cyr, M.A. (Oak Ridge Gaseous Diffusion Plant, TN (USA). Enrichment Technology Applications Center). Jul 1988. Contract AC05-84OR21400. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015574/JAW.

This report evaluates two different coating techniques for bonding the thermographic phosphor, europium-doped yttrium oxide (Y_2O_3:Eu), to nickel- and cobalt-based high-temperature alloys used in jet engine turbine blades and vanes. The refractory Y_2O_3:Eu is suitable for high-temperature surface thermometry when excited by an ultraviolet laser. The fluorescence lifetime of the 611-nm emission has a logarithmic temperature dependence from {approximately}700{degree}C to beyond 1000{degree}C, making it suitable for use as a noncontact temperature-monitoring technique for high-speed, high-temperature turbine engine components. Electron-beam deposition and the plasma-spray coating techniques were used to bond the Y_2O_3:Eu to standard Pratt & Whitney turbine blades and vanes. The coated blade and vane samples were then subjected to a standard-burner rig-endurance test for 8 h with a gas temperature of 1525{degree}C. It was concluded that both coating techniques can provide suitable coatings for use in an operating jet turbine engine for the measurement of turbine component temperatures. 41 figs.

49454 (SAND—87-2059C) **Rheological behavior of suspensions of randomly oriented rods: 3, Viscometer for opaque suspensions.** Powell, R.L.; Mondy, L.A.; Milliken, W.J.; Stoker, G.C.; Graham, A.L. (Sandia National Labs., Albuquerque, NM (USA); Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-880827—1; LA-UR—88-583). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88005625/JAW.

From 10. international congress on rheology; Sydney, Australia (14 Aug 1988).

With falling-ball rheometry, we have measured the apparent relative viscosity of suspensions of large, neutrally buoyant, rigid rods in a viscous Newtonian fluid, while approximately maintaining the rods in a randomly oriented configuration. A new technique for measuring the time of flight of a ball between two positions is used. This technique, based on an eddy-current detector, enables us to determine the position of a metallic (non-magnetic) ball falling through an opaque suspension, with an estimated inaccuracy of less than 1.5%. An electric signal, which peaks when the ball passes through the plane of the magnetic field, and the elapsed time are recorded using a computerized data acquisition system. The viscosities of two suspensions of different aspect ratio rods are compared at a particle volume fraction of 0.05.

49455 (SAND—88-0230C) **A differential absorption spectrometer for determining flash x-ray spectra from 10 to 2000 keV.** Carlson, G.A.; Lorence, L.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 19p. (CONF-880730—8). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014844/JAW.

From 25. annual conference on nuclear and space radiation effects; Portland, OR, USA (12 Jul 1988).

A differential absorption spectrometer has been developed and fielded on various bremsstrahlung sources (Pelletron, Saturn, and SPEED) with endpoint energies from 150 to 2000 keV. Spectral data were unfolded using response functions generated by TIGER and CEPXS/ONETRAN. Unfolded spectra are qualitatively in agreement with predicted spectra for steady-state bremsstrahlung sources from 150 keV to 900 keV. Applications and limitations of the diagnostic are discussed, and modifications and simplifications suggested.

49456 (SAND—88-1906) **Vacuum Fizeau wedge wavemeter for pulsed uv lasers.** Reiser, C.; Lykke, K.R. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015832/JAW.

We have constructed and tested a vacuum-spaced Fizeau wedge wavemeter that is suitable for measuring the wavelength of pulsed or continuous-wave lasers over the range of 630 nm to 200 nm. A Lasertechnics Model 100 Fizeau wavemeter was modified for ultraviolet operation and demonstrated an accuracy of 1.6 parts in 10^5 at 248 nm. Extensive computer modeling of the wavemeter has provided optimized design parameters for an improved unit. 9 refs., 6 figs., 2 tabs.

49457 (SAND—88-2016C) **Optical fiber ring resonators as fast energy impulse sensors.** Butler, M.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 13p. (CONF-8809105—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013980/JAW.

From SPIE O-E Lase: international symposium and exhibition on fiber optics, optoelectronics and laser applications; Boston, MA, USA (6 Sep 1988).

The use of optical fiber ring resonators to detect energy impulses is explored. These structures have limitations to their frequency response set by their dimensions and the speed of sound. For energy impulses which are slowly varying with respect to this intrinsic response time, the ring resonator generates a string of optical pulses. The frequency of this optical pulse train is a measure of the energy deposition rate and the total number of pulses is a measure of the total energy deposited. However, for energy impulses which are short compared to this intrinsic response time, the ring resonator behaves as a shock excited mechanical oscillator. Under these conditions the amplitude of oscillation is proportional to the total energy contained in the impulse. The sensitivity to various

forms of energy can be optimized by a suitable choice of coating. 5 refs., 6 figs.

49458 **(SAND—88-2077) Design study for a remote laser wavelength sensor.** Reiser, C. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 51p. NTIS, PC A04. Order Number DE88015417/JAW.

Design parameters and expected performance levels of a sensor that measures laser wavelength have been identified. The sensor may use either an Index Mismatched Interferometer (IMI) or a Girard Interferometer (GI). Suitable IMI materials for spanning the wavelength range of 0.3 to 10 microns are discussed, including KCl and KI:KCl. Many optical materials are suitable for GI construction. Quantitative results of modeling calculations relate wavelength reading accuracy to the direction and divergence of the incoming beam. Background blackbody light will not interfere with the wavelength determination unless it saturates the detector. It is found that the GI has wider performance and construction latitude than the IMI.

49459 **(UCRL—99175) Resolution limitations and optimization of the ITT F4157 streak tube focus for 10-ps operation.** Grasz, E.L.; Lerche, R.A.; Griffith, R.L. (Lawrence Livermore National Lab., CA (USA)). 8 Jul 1988. Contract W-7405-ENG-48. 9p. (CONF-880887—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014802/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

We studied the focusing properties of an ITT F4157 image tube that was biased at voltages far from the original design and is used for operation in an ultrafast (10ps) streak camera. Its output resolution at streak camera operating potentials was measured as a function of input slit width, incident-light wavelength, and focus-grid voltage, with results similar to those reported for the RCA C73435 streak tube. The temporal resolution is insensitive to focus-grid voltage for a narrow (50μm) input slit, but is very sensitive to focus-grid voltage for a wide (500μm) input slit. Spatial resolution is nearly independent of focus-grid voltage for values that give good temporal resolution. Both temporal and spatial resolution depend on the incident-light wavelength. Streak camera operation is simulated with a computer program that calculates photoelectron trajectories. Electron ray tracing describes the observed effects of slit width, incident-light wavelength, and focus-grid voltage on the output resolution. 5 ref., 10 figs.

49460 **Laser wavemeter with solid Fizeau wedge interferometer.** Reiser, C.; Lopert, R.B. (Sandia National Laboratories, Albuquerque, New Mexico 87185-5800). *Applied Optics;* **27**: No. 17, 3656-3660(1 Sep 1988).

A Fizeau wavemeter using a solid Fizeau wedge interferometer that is suitable for determining the wavelength of pulsed or cw laser light has been modeled and investigated experimentally. Accuracy of a few parts in 10^5 over a wide wavelength range can be achieved with careful design. Experimental accuracy of 2 parts in 10^6 was demonstrated over a range of 40 nm.

49461 **Wide temperature range IR spectroscopy cell for studies of adsorption and desorption on high area solids.** Basu, P.; Ballinger, T.H.; Yates J.T. Jr. (Surface Science Center, Department of Chemistry, University of Pittsburgh, Pittsburgh, Pennsylvania 15260). *Review of Scientific Instruments;* **59**: No. 8, 1321-1327(Aug 1988).

A new design for an infrared cell useful for studies of the spectrum of surface species on high area solids is presented. The cell is well suited over a wide temperature range (100—1000 K). Other demonstrated features of the cell include ultrahigh-vacuum operation, temperature control to +- 1 K, linear and rapid temperature programmability and low-temperature gradients across the powdered sample. The method of sample preparation and support minimizes both heat and mass transport effects. A detailed literature search of previous infrared cell designs is included. Results of the application of the new cell design to the high-temperature dehydroxylation of Al_2O_3 are given as an example of the performance.

49462 **X-ray response of silicon surface-barrier diodes at 8 and 17.5 keV: Evidence that the x-ray sensitive depth is not generally the depletion depth.** Wenzel, K.W.; Petrasso, R.D. (MIT Plasma Fusion Center, Cambridge, Massachusetts 02139). *Review of Scientific Instruments;* **59**: No. 8, 1380-1387(Aug 1988).

The absolute x-ray response of 18 EG&G Ortec partially depleted silicon surface-barrier diodes (SBDs) has been measured at 8 and 17.5 keV. In addition we have examined the x-ray response of four Tennelec and two United Detector Technology partially depleted SBDs. The variation in response to 8 keV x rays, for which the optical depth is about 5, is comparatively slight (approx. <12%). The variation in response to 17.5-keV x rays, for which the optical depth is only ~0.7, is comparatively large (~100%). These variations are mainly attributable to differences in the SBD physical thicknesses, and thus to differences in optical depth. At both 8 and 17.5 keV the diodes respond linearly to large variations in incident flux (over three orders of magnitude). This linearity, and the diode x-ray response, in general, is insensitive to large changes in the detector bias voltage; thus the depletion depth, proportional to the square root of the bias voltage, does not play a critical role in determining the x-ray sensitive depth.

49463 **Apparatus for measuring elastic constants of single crystals by a resonance technique up to 1825 K.** Goto, T.; Anderson, O.L. (Institute of Geophysics and Planetary Physics, University of California, Los Angeles, Los Angeles, California 90024). *Review of Scientific Instruments;* **59**: No. 8, 1405-1408(Aug 1988).

By holding the rectangular parallelepiped specimen between long, thinalumina buffer rods, we can detect the resonance vibration of a specimen even attemperatures above 1800 K. This new technique, in combination with the theoryfor the calculation of the resonance frequency spectrum of a rectangularparallelepiped specimen, enables us to determine the high-temperature elastic properties of single-crystal materials. The first application of this new device was to determine the elastic stiffness constants of single-crystal corundum up to 1825 K.

49464 **Compact friction and wear machine.** Hannigan, J.W.; Schwarz, R.B. (Center for Materials Science, Los Alamos, National Laboratory, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* **59**: No. 8, 1420-1422(Aug 1988).

We have developed a compact ring-on-ring wear machine that measures the friction coefficient between large area surfaces as a function of time, normal stress, and sliding velocity. The machine measures the temperature of the sliding surfaces and collects the wear debris.

49465 **High-temperature window seals for VUV experiments.** Muller C.H. III; Barrett, M.W.; Lowenthal, D.D. (Spectra Technology, Inc., 2755 Northup Way, Bellevue, Washington 98004). *Review of Scientific Instruments;* **59**: No. 8, 1425-1426(Aug 1988).

A simple and reliable technique for sealing laser quality vacuum-ultraviolet grade windows to high-temperature, bakable vacuum systems has been developed. Both 7.5-cm-diam MgF_2 and CaF_2 windows were found to be He leak tight to temperatures exceeding 330 °C. Smaller 4-cm-diam windows seal at temperatures exceeding 400 °C. The seals do not appear to be adversely affected by temperature cycling and they do not distort the optical quality of the window. The sealing technique has been used without failures in a Hg vapor four-wave-mixing cell that is used to produce high-power 130-nm coherent radiation.

49466 **Ionized channel generation of an intense-relativistic electron beam.** Frost, C.A.; Leifeste, G.T.; Shope, S.L. (to Dept. of Energy, Washington, DC). US Patent 4,748,378. 31 May 1988. Filed date 31 Mar 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for generating an intense relativistic electron beam is described consisting of: forming a strongly ionized channel containing positive ions and electrons, the channel having radius r/ sub c/ and extending from adjacent a cathode to a remote location;

and generating a pulse of high energy electrons from the cathode to the remote location along the channel, the electrons having a radius r/sub b/>=r/sub c/, whereby low energy electrons in the ionized channel are expelled by the high energy electrons leaving a positive core of ions which attract and guide the high energy electrons by partially neutralizing the space charge of the IREB, resulting in a focusing magnetic field.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 48446

49467 **(LA—11251-MS) A comparison between two epithermal neutron logging tools.** Deupree, R.G. (Los Alamos National Lab., NM (USA)). Sep 1988. Contract W-7405-ENG-36. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015047/JAW.

The two epithermal neutron tools currently in use at the Nevada Test Site are compared to see which gives better performance and which is the more reliable. We have compared these tools by examining logs run in the same large-diameter boreholes, comparing results obtained from the calibration facility for these tools, and running Monte Carlo simulations of both tools in a borehole geometry. From our examination of logs run in the same boreholes, we find that the newer tool generally tend to yield more reliable data, both in terms of accuracy and consistency, and is able to obtain reliable data where the other tool cannot. The borehole data also suggest that there is a reasonably well-defined relationship between the count rates of the two tools but that the ratio of the count rates is not constant. The trend in this relationship is maintained in a comparison of the calibration facility data, but the actual ratio of the count rates suggested by the calibration facility is lower. The Monte Carlo calculations also confirm the trends found in the data, but they are not sufficiently accurate to resolve the issue. However, the fact that all three comparisons show the same trends is significant. Using these results, we develop an approach to obtain the water content from this newer tool and recommend that Los Alamos use this approach in its epithermal neutron logging. 1 ref., 5 figs., 2 tabs.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

49468 **(AD-A—193152/6/XAB) Numerical modeling of airblast. Final report, 10 October 1986-10 October 1987.** Fry, M.A. (Science Applications International Corp., McLean, VA (USA)). Jun 1987. 289p. (SAIC—87/1701). NTIS, PC A13/MF A01.

Contents include: Appendix A: source listing of the 2-D axisymmetric and cartesian nuclear and non-nuclear modeling code; Appendix B: abstract for DNA dust symposium; Appendix C: chemical explosive charge study using 3-D FCT code; and Appendix D: compilation listing of FLIK 3D graphics code.

49469 **(AD-A—193372/0/XAB) Automated diaphragm loading for the LB/TS (large blast/thermal simulator). Technical report, 30 September 1985-28 February 1986.** Osofsky, I.B.; Mason, G.P.; Hove, D.T. (Science Applications International Corp., San Diego, CA (USA)). 28 Feb 1986. 116p. (SAIC—86-1529). NTIS, PC A06/MF A01.

This study describes a design investigation of a cartridge-loading diaphragm system for the LB/TS. A diaphragm geometry was evaluated; a number of materials were investigated for use in the diaphragms and cartridge system. Cooling and heating analyses were conducted. A mechanical diaphragm opener was investigated. Manufacturing techniques and costs were investigated. Structural analyses were conducted.

49470 **(LA-UR—88-2523) Single crystal orientation effects in shock initiation of PETN explosive.** Dick, J.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-8809109—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014406/JAW.

From Shock wave symposium; Pullman, WA, USA (1 Sep 1988).

Over the past nine years in Los Alamos we have studied shock initiation of detonation in single crystals of PETN explosive. We have demonstrated the effects of point defects and crystal orientation on shock sensitivity. Here we report recent work on orientation effects and anomalous detonation in <110> orientation at 4 GPa. 5 refs.

49471 **(MLM—3501(OP)) Detection of the alpha and gamma polymorphs of HMX in beta-HMX by Raman spectroscopy.** Holy, J.A.; Firsich, D.W.; Walters, R.R. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1988. Contract AC04-76DP00053. 7p. (CONF-880473—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012867/JAW.

From American Defense Preparedness Association Compatibility symposium; New Orleans, LA, USA (18 Apr 1988).

HMX (octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine) is an important military explosive which exhibits four polymorphic forms- alpha, beta, gamma, and delta. Commercial lots of this compound are analyzed for polymorphic composition in order to achieve predictable firing characteristics. This analysis may be done qualitatively with powder diffraction, while quantitative results are typically obtained through infrared spectroscopy performed of a nujol mull. The grinding action inherent in the preparation of a nujol mull causes changes in two of the polymorphs. These changes are caused by the pressure generated during the grinding process. Larger errors result when significant amounts of the gamma or delta form are present due to the composition-altering effects of sample grinding. Delta-HMX is normally absent from samples that have been solution processed because this form is thermodynamically favored only at high temperatures (>{approx←gt}140{degree} C). In addition, small amounts of delta-HMX that might be present can readily transform morphology under the mechanical action of normal handling. It is for both these reasons that it is impractical to pursue the quantitative analysis of this form, and we will not do so here. The Raman spectra of beta-HMX have previously been measured and shown to have many intense peaks. The Raman spectra have been used to measure the transformations between polymorphs as a function of pressure and temperature. The results reported here show that Raman spectroscopy can be used to detect the alpha and gamma phases in beta-HMX at concentrations well under 1%. 13 refs., 6 figs.

49472 **(SAND—88-0679C) Semiconductor Bridge (SCB): A new method for the ignition of explosives and pyrotechnics.** Bickes, R.W. Jr. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 13p. (CONF-880976—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88011246/JAW.

From 1. IFAC workshop on advances in automation; Quebec, Canada (12 Sep 1988).

Small metal bridgewires (hot wires) are often used to ignite energetic powders such as propellants, pyrotechnics and explosive powders. We have developed a new means for ignition of such powders using a semiconductor bridge or SCB which is heavily doped polysilicon film 100 μm long by 380 μm wide by 2 μm thick. When driven by a short (less than 20μs), low energy (less than 3.5 mJ) current pulse, the SCB produces a hot plasma that ignites the explosive material pressed against it. SCB explosive devices function in a few tens of microseconds and operate at one-tenth the input energy of conventional hot-wire devices. Despite the low energy for ignition, tests have revealed the SCB devices to be electrostatic discharge safe and less sensitive to no-fire current levels than hot-wire components. We report in this paper data obtained comparing a pyrotechnic SCB actuator with its hot-wire analog, a comparison of an SCB thruster with its hot-wire equivalent and test results for a prototype SCB lead azide detonator. In addition, because the SCB is compatible with digital circuitry, we are developing "smart" components which will incorporate the SCB into a single thumb size package (containing the SCB and firing set) which is controlled by digital signals. Thus programmed firing (such as accurate delay sequences) of SCB devices is easily achieved. We describe in this paper a prototype delay device and a

sequential firing experiment in which twenty actautors were fired in a programmed sequence. 11 refs., 11 figs., 3 tabs.

49473 **(SAND—88-0681C) Explosion airblast predictions on a personal computer and application to the Henderson, Nevada, incident.** Reed, J.W. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 13p. (CONF-880891—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014991/JAW.

From 23. DOD explosives safety seminar; Atlanta, GA, USA (9 Aug 1988).

An airblast prediction program for explosions, called BLASTO, has been written for use with IBM-PC (or compatible) computers, to produce overpressure-distance curves for a variety of interactive input conditions. Several common units are allowed for each input, but calculation and output are in SAI metric units. Explosion yield (chemical or nuclear) and ambient atmospheric pressure are used to generate a referenced 'Standard' overpressure-distance curve. Explosives may be point charges at any height, above ground or depth below the earth surface. Buried charges may also be distributed in a sheet, or 'HEST' configuration. If upper air weather data or forecasts are available, they can be used to generate directed (wind effects) sound velocity versus height structures which are interpreted to give attenuated or enhanced overpressure-distance curves. These are calculated for directions around the compass or toward specified targets or communities. Evaluation of the recent accidental explosion at an ammonium perchlorate (A-P) plant in Henderson, Nevada, made use of BLASTO. Damage inspection gave some estimates for incident overpressure at various ranges. These showed considerable scatter, but they generally surrounded an overpressure versus distance curve calculated for 1-kt NE free-air burst. Weather data and directed sound velocity calculations showed that some of the closest residential damages were in directions of minimal weather-dependent blast distortion, allowing the conclusion that the largest explosion could be simulated by a 250-ton HE surface burst. Video-camera recordings, newspaper eye-witness accounts, post-accident aerial photographs, seismic recordings, and a report of the A-P storage pattern have been reviewed to show that this largest blast probably occurred in a 1500-ton A-P collection. This leads to 1:6 TNT airblast equivalence for A-P. 15 refs., 9 figs.

49474 **(SAND—88-1438C) Smart semiconductor bridge (SCB) igniter for explosives.** Bickes, R.W. Jr. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 8p. (CONF-880986—1). NTIS, PC A02. Order Number DE88012669/JAW.

From 3. Canadian symposium on mining automation; Montreal, Canada (14 Sep 1988).

We have developed a silicon semiconductor bridge (SCB) igniter which, when driven with a low-energy current pulse, produces a plasma discharge that ignites explosive materials pressed against the bridge. Our experiments have demonstrated that SCB explosive devices function in a few tens of microseconds at one-tenth the input energy of hot-wire devices. Despite the low input energies for ignition, tests have revealed SCB devices to be explosively safe, passing electrostatic discharge (ESD) requirements and no-fire current levels. In fact, SCB devices have better no-fire characteristics than hot-wire devices, because of the intimate bridge contact with the underlying thermally conductive substrate. We have tested several different prototype explosive devices including pyrotechnic actuators, secondary explosive deflagration-to-detonation detonators and a primary explosive detonator. In addition, we have tested SCB actuators with breadboarded "smart" firing sets that will fire the SCB actuators only after transmission of a digital code, after a preset delay, or in a preprogrammed sequence. We have also tested an optical system that requires only a single fiber optic cable connecting the SCB device to a low power laser that both energizes the firing set and transmits a coded firing signal. 9 refs., 19 figs.

4502 Nuclear

REFER ALSO TO CITATION(S) 48322, 48720, 48731, 48956, 48958, 49536, 49805, 50000

49475 **(AD-A—192991/8/XAB) Cleanup of Johnston Atoll missile-launch facility. Technical report.** Vesper, B.E.; Dooley, M.; Mohaupt, T.H.; Bramlitt, E.T. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). Mar 1988. 23p. (AFRRI-TR—88-1). NTIS, PC A03/MF A01.

In July 1962, when a missile failed to lift off from the launch pad, a nuclear test device was intentionally detonated to prevent any nuclear yield. In 1980, a long-range program was developed to remove the contaminated material from the test site. In 1984, funds became available to transport the contaminated material to a Federal radioactive-waste disposal site. The waste disposal project involved the dismantling of structures remaining on the site, decontaminating several concrete pads, determining the level of contamination on the debris, preparing and packaging the debris for shipment, and transporting the contaminated material to an authorized waste disposal site. Because the operation involved sea and land transport of a large volume of plutonium-contaminated material, it had the potential of becoming controversial. However, in-depth planning and extensive coordination with appropriate agencies enabled the operation to proceed without incident. This report addresses the planning process, cleanup options considered, instrumentation and measurement techniques, and personnel radiation safety practices. Included are a brief background of the situation, a summary of the planning phase and regulatory guidelines, detailed description of the operation, and discuss of some of the unique circumstances and relevant problems encountered during this project.

49476 **(AD-A—193027/0/XAB) Strategic planning, Polaris, and Tomahawk: technological imperative hypotheses. Master's thesis.** Norris, D.T. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1987. 127p. NTIS, PC A07/MF A01.

This thesis examines the force procurement element of the military strategic planning process and is comprised of two parts. First, models are constructed to depict ideal strategic planning. The initial step in each model is the formulation of the national interest. The national interest is defined in terms useful to strategic planners by creating a unique paradigm based on the Constitution. The technological imperative hypothesis is explored as an aberration to the ideal strategic planning process. Second, the technological imperative hypothesis is tested with case studies of the Polaris and the Tomahawk. Even though the hypothesis was disproved in each case, the case studies yielded useful relationships between technology, strategy, and doctrine.

49477 **(AD-A—193520/4/XAB) Analysis of radiation exposure - service personnel on Rongerik Atoll: Operation Castle - Shot Bravo. Technical report, 12 March 1985-12 June 1987.** Goetz, J.; Klemm, J.; Phillips, J.; Thomas, C. (Science Applications International Corp., McLean, VA (USA)). 9 Jul 1987. 49p. (SAIC—86/1608). NTIS, PC A03/MF A01.

External and internal doses are reconstructed for the 28 American servicemen stationed on Rongerik Atoll, Marshall Islands, who were exposed to fallout on 1-2 March 1954 from Shot Bravo of Operation CASTLE. External doses are determined from limited radiation survey and film-badge information. Internal-dose commitments are derived from urinalysis data. The magnitude of the calculated activity intake suggests the principal pathways. Reconstructed film-badge doses are approximately 40 rem, with adjustments from individual activity scenarios, as available. Internal dose commitments to the thyroid and large intestine (nearly all first-year dose) provide the only significant increments to the external dose. Total doses are approximately 230 rem to the thyroid, 115 rem to the lower large intestine, 85 rem to the upper large intestine, and about 40 to 50 rem to all other organs.

49478 (EGG-PHY—8021) Valve opening time requirements for LB/TS [Large Blast/Thermal Simulator]. Berry, R.A.; Lassahn, G.D. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1988. Contract AC07-76ID01570. 118p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88015123/JAW.

Computer calculations were done to determine the maximum allowable valve opening times for producing certain specified shock overpressures in the proposed Large Blast/Thermal Simulator for the US Army Ballistic Research Laboratory. The maximum allowable valve opening times ranged from 63 milliseconds for the high pressure cases to 21 milliseconds for the low pressure cases.

49479 (ORNL—6399) Nuclear Winter: Implications for civil defense. Chester, C.V.; Perry, A.M.; Hobbs, B.F. (Oak Ridge National Lab., TN (USA)). May 1988. Contract AC05-84OR21400. 161p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88013329/JAW.

"Nuclear Winter" is the term given to the cooling hypothesized to occur in the Northern Hemisphere following a nuclear war as the result of the injection of smoke from burning cities into the atmosphere. The voluminous literature on this subject produced since the paper was published in 1983 by Turco, Toon, Ackerman, Pollack, and Sagen (TTAPS) has been reviewed. Three-dimensional global circulation models have resulted in reduced estimates of cooling---15 to 25{degree}C for a summer war and a few degrees for a winter war. More serious may be the possibility of suppression of convective precipitation by the altered temperature profiles in the atmosphere. However, very large uncertainties remain in input parameters, the models, and the results of calculations. We believe the state of knowledge about nuclear winter is sufficiently developed to conclude: Neither cold nor drought is likely to be a direct threat to human survival for popuiations with the wherewithal to survive normal January temperatures. The principal threat from nuclear winter is to food production, and this could present problems to third parties who are without food reserves. Loss of a crop year is neither a new nor an unexpected threat from nuclear war to the United States and the Soviet Union. Both have at least a year's food reserve at all times. Both face formidable organizational problems in distributing their reserves in a war-damaged environment. The consequences of nuclear winter could be expected to fall more heavily on the Soviet Union than the United States due to its higher latitude and less productive agriculture. This may be especially true if disturbances of rainfall amounts and distribution persist for more than a year.

49480 (PNL-SA—15881-1) A tool for site restoration planning following a nuclear weapons accident: Part 1: Program structure and data. Tawil, J.J. (Pacific Northwest Lab., Richland, WA (USA)). May 1988. Contract AC06-76RL01830. 16p. (CONF-8806197—1-Pt.1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014765/JAW.

From US/Republic of France bilateral symposium on response to accidents involving trasuranium elements; Orleans, France (20 Jun 1988).

The site restoration planning tool is described in this paper is called the Site Restoration Program, or SRP for short. It consists of several individual software programs that have application in evaluating the consequences of radiological accidents and in developing site restoration plans and strategies. The objectives of this paper are to: provide a brief description of the various components of the SRP and show their interrelationships, describe the knowledge database of the SRP, and to describe the site-specific data requirements of the SRP.

49481 (UCID—20950-87) Control System Research for Directed Energy Weapons: FY87 annual technical report. Young, D.K. (ed.). (Lawrence Livermore National Lab., CA (USA); Illinois Univ., Urbana (USA); University of Southern California, Los Angeles (USA); Stanford Univ., CA (USA); Ohio State Univ., Columbus (USA); Santa Clara Univ., CA (USA)). Dec 1987. Contract W-7405-ENG-48. 461p. NTIS, PC A20/MF A01; 1; GPO Dep. Order Number DE88015371/JAW.

This paper discusses the different control systems that are being considered to direct directed energy weapons. The control methods discussed are: large scale systems control methods; robust control methods; decentralized/relegated control methods; multirate digital control; decentralized multirate control; and distributed finite element modeling and controls.

49482 (UCRL—53875) Allocating and launching MaRV interceptors based on miss distance predictions. Corynen, G.C. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 135p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88015370/JAW.

We have developed battle management algorithms for assigning and launching ground-based interceptors to neutralize a threat consisting of multiple decoyed MaRVs and BRVs in their terminal phase. Decisions are based on the minimization of expected leakage risk, and they specifically account for uncertainties and errors in the identity of each threat object, although detailed discrimination issues are not discussed. In contrast to standard probabilistic approaches, the algorithms are physics-based and use kinematic and geometric models for estimating interceptor-MaRV miss distances and probabilities of kill to determine optimal waiting times before launch. Based on a test comparing interceptor and MaRV technologies, the minimax algorithm finds the waiting times for which the minimum probability of kill is a maximum. To avoid a full multidimensional optimization, we use a "greedy" one-dimensional approach where only the most urgent threat is addressed optimally, conditional to allocating to the remaining threats (dimensions) a nominal quantity of interceptors, determine by previous optimizations. One-on-one engagements are thus emphasized, and the preponderance of the work discussed in this report was directed towards the development of a miss distance prediction algorithm, called the MD Algorithm. While functional and software testing of the whole battle manager is still under way, experiments with MD algorithm have been completed and have provided useful insights which generally agree with conclusions reached by others. It was found that miss distances are not very sensitive to reliable interceptor-MaRV velocities but are quite sensitive to relative maneuvering capabilities, as measured by relative lateral acceleration limits. More specifically, for MaRVs and interceptors with conventional capabilities, and for a total defense system response time of 0.1 second, the minimax miss distance was predicted to be about 600 feet. 5 refs., 53 figs.

4503 Explosion Detection

49483 (PB—88-214853/XAB) Seismic verification of nuclear-testing treaties. (Office of Technology Assessment (U.S. Congress), Washington, DC). May 1988. 150p. (OTA-ISC—361). NTIS, PC A07/MF A01.

Also available from Supt. of Docs. Library of Congress catalog card no. 88-600523.

To a great extent, the capabilities of any given seismic monitoring networks are determined by how the monitoring network are determined by how the monitoring task is approached and what supplementary provisions are negotiated within the treaty. If agreements can be negotiated to reduce uncertainty, then seismology can be very effective and extremely low yields could be monitored with high confidence. The report addresses two key questions: (1) down to what size explosion can underground testing be seismically monitored with high confidence, and (2) how accurately can the yields of underground explosions be measured seismically. The answers to these questions provide the technical information that lies at the heart of the political debate over: (1) how low a threshold test ban treaty with the Soviet Union the authors could verify, (2) whether the 1976 Threshold Test Ban Treaty is verifiable, and (3) whether the Soviet Union has complied with present testing restrictions.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 48880, 49821

49484 (AD-A—193917/2/XAB) High-power microwave interaction with air. Final report, 21 January 1981-20 January 1982. Bollen, W.M.; Lee, C.L.; Nagurney, M.J. (Mission Research Corp., Alexandria, VA (USA)). May 1982. 94p. (MRC/WDC-R—025). NTIS, PC A05/MF A01.

The computer-simulation code MINI was developed to study microwave interaction with nitrogen. MINI has self-consistent wave optics, nitrogen chemistry, and hydrodynamic effects included. A number of simulations were performed and compared to experiment showing reasonable agreement.

49485 (DOE/ER/60397—T3) Detection of CO_2-induced climatic change: Progress report, 16 July 1987--15 July 1988. Wigley, T.M.L.; Jones, P.D. (East Anglia Univ. (UK). Climatic Research Unit). 15 Jul 1988. Contract FG02-86ER60397. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014134/JAW.

The aims of the US Department of Energy's CO_2 Climate Research Program are to improve assessments of CO_2-induced climatic change and to define and reduce uncertainties through selected research. Questions that have direct bearing on this project includes (1) What are the regional and seasonal details of the expected climatic changes? (2) How rapidly will these changes occur? (3) How and when will the effects of CO_2 be first detected? (4) What are the linkages and relationships between CO_2-induced climatic change and changes caused by other external agents (such as changes in solar output and volcanic activity) and internal factors (such as changes in ocean circulation)? The present project addresses the last three questions. The project spans the period 1 December 1985 to 30 November 1988. The main elements of the project, together with an approximate timetable, are shown. We list publications that have arisen from the project to date (including items "in press"), together with a list of papers that have been submitted to journals but which are still undergoing peer review. 25 refs.

49486 (NP—8770358) Atmospheric sulfur compounds: Sources and tropospheric oxidation processes. Barnes, I.; Bastian, V.; Becker, K.H.; Wirtz, K. (Wuppertal Univ. ({Gesamthochschule) (Germany, F.R.). Fachbereich 9 - Naturwessenschaften 2 - Chemie - Biologie). Aug 1986. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770358/JAW.

The sources of sulfur compounds active in the global sulfur cycle are briefly reviewed. Results from studies on the kinetics and products of the OH initiated oxidation of these compounds under approximate atmospheric conditions in simulation chambers are reported and compared with the literature data. Some preliminary results from investigations on the reactions of SO/sub 3/ with atmospheric trace gases are also presented.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 48047, 48048, 48049, 48050, 48051, 48052, 48053, 48082, 48088, 48172, 48173, 48175, 48307, 48702, 48877, 49485, 49598, 49653, 49721, 49724, 49725, 49726, 49727, 49729, 49730, 49731, 49743, 49744

49487 (AD-A—193344/9/XAB) Chemical-Stockpile Disposal Program. Evaluation of multiple-incinerator air-quality impacts, Edgewood Area, Aberdeen Proving Ground. Final report, November 1986-May 1987. (Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD (USA)). May 1987. 15p. (USAEHA—43-21-1229-87). NTIS, PC A03/MF A01.

See also AD-A193 345.

The purpose of this study was to examine the long-term additive ambient impact of certain toxic air pollutants that will potentially be emitted from the Chemical Agent Incinerator (AI) proposed for the Edgewood Area (EA) of Aberdeen Proving Ground (APG), Maryland and from three additional planned or existing incinerators also located on the EA. This impact was determined in consideration of the existence and operation of three additional planned or existing incinerators also located on EA. Based on air-dispersion modeling conducted as part of an original analysis, emissions were estimated of chlorinated organics from the U.S. Army Medical Research Institute for Chemical Research, Development and Engineering Center Decontamination/Detoxification Municipal Waste Incinerator (MWI), for downwind distances as great as the distance to the nearest boundary of the EA. Consequently, for this evaluation, only the MWI is considered to emit chlorinated organics.

49488 (AD-A—193802/6/XAB) Model for calculating dispersion and deposition of small particles from a low-level point source. Mellsen, S.B. (Defence Research Establishment Suffield, Ralston, Alberta (Canada)). Feb 1988. 90p. (DRES—500). NTIS, PC A05/MF A01.

A mathematical model for estimating concentrations and ground-deposition densities from a low-level point source of particulates up to 20 micrometers in diameter has been developed. The model applies K theory to account for vertical dispersion and Gaussian spread to account for lateral dispersion. Results for the limiting case of zero terminal velocity with negligible retention at the ground are compared directly to field experimental data for a source near ground level to establish the validity of using Gaussian lateral dispersion from an elevated source. The vertical dispersion function and lower boundary condition for an existing line-source model were applied in the present point-source model. Previous comparison to ground-deposition densities measured in various field experiments indicate that estimates from the line-source model are reasonable, although further experiments would be useful.

49489 (BNL—41188) Characterization of a calibration source and gas chromatographic system for the measurement of ambient pan. Roberts, J.M.; Fajer, R.W.; McIntire, D.M. (Brookhaven National Lab., Upton, NY (USA)). Mar 1988. Contract AC02-76CH00016. 6p. (CONF-880912—7). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88010522/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

Field measurements of peroxyacetyl (PAN) by GC with electron capture detection, requires a calibration method that is portable, stable with time, and accurate. The source used here consisted of a solution of PAN in tridecane which was contained within a capillary diffusion cell held at O{degree}C. A stable, low concentration of PAN in a gas stream was produced from this, and accurately calibrated by conversion to NO and analysis by O_3 chemiluminescene. The major impurities in this PAN source were methyl nitrate and HNO_3. Methyl nitrate arose from the unimolecular decomposition of PAN, and was observed to vary from 4% initially to almost 25% after a month. HNO_3 probably resulted from hydrolysis of PAN in the presence of H_2O impurities and varied from <1% to 17% after a month. An accuracy of +-25% was obtained at [PAN] = 1 ppbv and a detection limit of 0.01 ppbv was possibl; e with 5 cc samples. 8 refs., 1 fig.

49490 (BNL—41221) Evaluation of springtime nitrogen oxide and oxidant data from a suburban/rural northeast USA surface site. Tanner, R.L.; Roberts, J.M.; Gaffney, J.S.; Sisterson, D.L. (Brookhaven National Lab., Upton, NY (USA); Los Alamos National Lab., NM (USA); Argonne National Lab., IL (USA)). Mar 1988. Contract AC02-76CH00016. 8p. (CONF-880912—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number TI88009892/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

Full characterization of the air chemistry (gases, particles and meteorology) was accomplished for a rural site in Bucks County, PA during April 1985, in connection with PRECP field experiments. Data from continuous monitoring of nitrogen oxides (NO/sub y/), nitric acid, ozone and SO_2 are used in this evaluation along with PAN analyses every 30 min, meteorological data from surface observations and a single theodolite radiosonde system, and

selected aerosol compositions and gaseous aldehyde data. Limited precipitation composition data from a manual sequential sampler is available including common ions, dissolved SO_3 and H_2O_2. Correlation matrices, averaged diurnal trends, and pollution roses will be presented indicating strong relationships between ozone and the secondary nitrogen oxide species, HNO_3 and PAN. Periods of impact from the greater Philadelphia and New York source regions can be identified from NO/sub y/ and SO_2 data, but anticyclonic flow in aged air masses advected from the west resulted in the major importation of secondary nitrogen(V) and sulfur(VI) species (HNO_3, PAN and aerosol sulfate) to this site. 16 refs.

49491 **(CONF-880970—1) Behavior of Cd, Mn, and Pb in forest-canopy throughfall.** Lindberg, S.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88011020/JAW.

From SCOPE workshop on atmospheric trace metals; Oslo, Norway (12 Sep 1988).

The concentrations and fluxes of Cd, Mn, and Pb were measured in wet-only precipitation events sampled above and below forest canopies at the Walker Branch Watershed in the southeastern United States over a 2-year period. The interaction of rain with the canopy resulted in a measurable increase in the concentrations of all metals in throughfall, most significantly in the concentration of Mn (which increased by a factor of 160 compared to a factor of 3 to 4 for Cd and Pb). The factors influencing the behavior of these metals in throughfall included their concentrations in the incoming rain, the amount of foliage on the trees, the rain amount, and the storm intensity. The amount of metal removed from the canopy during rain increased significantly as the residence time of the rain on the foliage surface increased. Canopy mass balance calculations using independent estimates of dry deposition suggest that the primary source of Pb in throughfall below these canopies is atmospheric deposition, while the major source of Mn is leaching from internal tree tissues. Both sources are important for Cd. 32 refs., 10 figs., 4 tabs.

49492 **(CONF-880985—1) Environmental quality changes arising from the replacement of diesel oil-fueled buses by methanol-fueled buses.** Santini, D.J.; Saricks, C.L.; Sekar, R. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012011/JAW.

From FISTA '88: automotive systems technology - the future; Dearborn, MI, USA (25 Sep 1988).

On the basis of existing and projected rates of emissions of presently regulated pollutants and accepted data concerning ozone formation, changes in local and regional air quality resulting from replacement of diesel oil-fueled buses by methanol-fueled buses are estimated for a representative urban area. Occupational exposures of bus garage workers are examined. Bus maintenance and refueling procedures that minimize the chances of deleterious occupational exposure are contrasted with those for diesel buses. Probable levels of urban-resident and bus company-worker pollutant exposure under good operating procedures for diesel and methanol-fueled buses are estimated, and an overall comparison of environmental quality is made, based on this information for both types of buses. A comparison is made of the environmental consequences of leaks and spills of methanol and diesel fuel during transportation and storage and in fueling the vehicles. Conclusions are reached about the net environmental advantages of methanol-fueled buses relative to diesel buses. Cost-benefit studies that place an economic value on the environmental benefits of methanol buses are examined, to develop a general indication of the ratios of methanol and diesel fuel prices that make adoption of methanol buses desirable. 36 refs., 2 figs., 5 tabs.

49493 **(CONF-8803128—1) Evaluating impacts of pollutants from the atmosphere.** Grigal, D.F.; Turner, R.S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014550/JAW.

From International interactive workshop on soil resources: their inventory, analysis and interpretation for use in the 1990s; Minneapolis, MN, USA (22 Mar 1988).

As a result of industrialization, concentrations of many compounds have increased in the atmosphere. Deposition of some of these compounds from the atmosphere to soil has been hypothesized to alter soil properties. These alterations may adversely affect plant growth and create conditions for movement of toxic materials from terrestrial to aquatic systems. Acidic deposition, in both wet and dry forms, can displace and hence remove nutrient cations from the rooting zone. Associated declines in pH can increase the solubility of toxic metals such as Al. In acid soils, increasing SO_4^{2-} concentrations in soil solution from atmospheric deposition can also mobilize Al. Atmospheric deposition can also increase the concentration of other toxic metals, such as Pb and Hg, in soil. Assessment of the impacts of deposition on soil may depend on before--and--after sampling, whereby results of recent analyses are compared to results either from older reports or from reanalysis of archived samples. Changes in laboratory procedures and uncertainty about sampling location affect the first method, whereas limited numbers of archived samples and changes in properties during storage affect the second method. Assessment of impacts can also be made by field measurements of soil solution chemistry or by measurements of changes in soil chemical properties. Such measurements, however, are both expensive and difficult to obtain for many sites. 102 refs.

49494 **(DOE/ER/60372—3) Recent climate change in North America and CO_2: Search in stratified daily data: Progress report, April 30, 1987-August 15, 1988.** Kukla, G.J.; Gavin, J.E.; Karl, T.R. (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory; National Climatic Data Center, Asheville, NC (USA)). Aug 1988. Contract FG02-85ER60372. 16p. NTIS, PC A03. Order Number DE88014669/JAW.

The present report covers the results obtained from April 1987 through August 1988. Our objectives were to identify the CO_2 fingerprint using stratified daily weather records, to characterize recent climate fluctuations in North America in terms of the changing frequency and distribution of various daily weather types, to determine empirical relationships of surface air temperature and various meteorological elements (humidity, cloud cover, wind, precipitation, etc.), and to compare these results with that produced by GCM's. 15 refs., 7 figs.

49495 **(DP-MS—87-164) Air quality protection program at the Savannah River Plant.** Huang, Ju-Chrong. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 37p. (CONF-880729—2). NTIS, PC A03. Order Number DE88014793/JAW.

From 33. annual meeting of the Health Physics Society; Boston, MA, USA (4 Jul 1988).

To protect human health and safety, meet regulatory emissions requirements, and comply with other applicable DOE and corporate requirements, Du Pont has developed a comprehensive Environmental Implementation Plan for the Savannah River Plant (SRP). This Environmental Implementation Plan contains program objectives and strategies for all environmental media including air. The presentation describes our experiences in managing the air quality protection program. Program objectives and strategy are presented. Program implementation will then be reviewed in terms of our performances in the air emission permitting, air quality assessments, radioactive and nonradioactive management, emergency response, and air emission inventory. Air quality protection activities involving quality assurance, environmental audit, and environmental awareness will not be addressed in this presentation. 30 figs.

49496 **(LBL—25348-App.) Real-time measurement of the size fractionation of aerosol black carbon during the South Coast Air Quality Study, June 13-September 4, 1987, Claremont College, Claremont, California: Preliminary report: Appendix, Hourly mean aerosol black carbon concentrations measured during the summer 1987, Southern California air quality study.** Hansen, A.D.A.; Novakov, T. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88014862/JAW.

During the periods June 13 to July 28 and August 17 to September 4, 1987, the Atmospheric Aerosol Group of Lawrence Berkeley Laboratory participated in the South Coast Air Quality Study conducted at Claremont College, Claremont, California. We used a multi-channel aethalometer preceded by size-selective inlets to determine the concentration of aerosol black carbon in two size ranges in real time. We present our results from this study in the form of one-hour and periodic (typically 12-hour) averages of carbon concentrations for the total suspended aerosol and for the fraction having aerodynamic diameter smaller than approximately 0.3 μm. The total concentration results show daily mean values generally ranging from 1 to 4 μg/m³, with a diurnal cycle showing little variation during nighttime hours and a pronounced peak between the hours of 8 a.m. and 10 a.m.. The results for the size fractionation show that the great majority of the aerosol black carbon was found in the size range smaller than 0.3 μm: however, this fraction showed a systematic diurnal variation with a decline in the morning and the mid-day periods. This appendix contains only the data.

49497 **(NP—8770298) Environmental research and environmental protection programme, 1986/1987.** (Arbeitsgemeinschaft der Grossforschungseinrichtungen (AGF), Bonn (Germany, F.R.)). 1987. 26p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770298/JAW.

The AGF-programme (Association of the Large-Scale National Research Centers) is to present the research and development work of large-scale research centers in the various environmental fields; ensure effective coordination and reciprocal synchronization by the large-scale research centers in their functional planning, allow a sound, public opinion-leading on the role of the large-scale research centers in the environmental sector. The booklet offers an analysis of environmental pollution, deals with environment and health, abatement techniques, climate and the total expenditure in each thematical field. (orig./HSCH).

49498 **(NP—8770370) Development and testing of an oxidizing exhaust air cleaning by reactive oxygen.** Huss, R.; Bamberger, E. (Gesellschaft fuer Technische Studien, Entwicklung, Planung G.m.b.H. (SEP), Muenchen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Feb 1986. 99p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88770370/JAW.

A procedure to clean exhaust air electrochemically was developed and tested. The means of oxidation was reactive oxygen (OH-radicals and atomic oxygen). It was produced electrolytically at a PbO/sub 2/-titanium-compound anode in an aqueous electrolyte. The works comprised the development and optimization of electrolytic cells, the construction of a pilot plant, as well as the execution of tests for determining the efficiency with relevant malodourants. (orig.) With 12 figs., 14 tabs., 10 refs.

49499 **(PB—88-202379/XAB) Dispersion model for elevated dense-gas-jet chemical releases (DOMS/DEGADIS) (for microcomputers). Software.** Guinnup, D. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Apr 1988. vp. NTISCP D99.

The software is contained on 5 1/4-inch diskette, double sided, double density compatible with the IBM PC microcomputer. Diskettes are in ASCII format. Price includes documentation, PB—88-202387 and PB—88-202395.

The computer program, Ooms/DEGADIS, found on these diskettes and described in the EPA report entitled, A Dispersion Model for Elevated Dense Gas Jet Chemical Releases - Volumes 1 & 2 (EPA 450/4-88-006a & b), is a VAX-operational program designed to simulate the dispersion of heavier-than-air gases which are emitted into the atmosphere with significant velocity through elevated ports. The program incorporates the sequential execution of two models. The first one (Ooms) calculates the trajectory and dispersion of the gas plume as it falls to the ground. The second (DEGADIS) calculates the downwind dispersion of the plume after it touches the ground. Users are referred to the Preface in the User's Guide for specific instructions for program implementation...Software Description: The program is written in FORTRAN with specific intent for compilation and execution on a Digital Equipment Corporation VAX computer. Implementation of the model on any other computer system may be attempted at the risk of the user. To facilitate dissemination of the model, it is being provided on two PC-compatible diskettes. The model should be uploaded via modem from a PC terminal to host VAX computer, and several files must then be renamed prior to compilation and execution.

49500 **(PB—88-202395/XAB) Dispersion model for elevated dense-gas-jet chemical releases. Volume 2. User's guide.** Havens, J. (Arkansas Univ., Fayetteville (USA)). Apr 1988. 377p. NTIS, PC A17/MF A01.

For system on diskette, see PB—88-202379. See also Volume 1, PB—88-202387.

The mathematical modeling techniques used to predict atmospheric dispersion of denser-than-air gases in the Ooms and DEGADIS models are briefly summarized. The Ooms/DEGRADIS model was written in FORTRAN with specific intent for compilation and execution on a Digital Equipment Corporation VAX computer. The Ooms model describes the release and subsequent dilution and trajectory of an elevated gas jet as a gas plume. If the plume falls to ground level, DEGADIS describes the resulting ground-level plume. DEGADIS can also be used to describe the release and dilution from a low-momentum, ground-level release. The necessary model-input information to simulate a denser-than-air gas release is summarized. Example simulations of steady-state and transient release and guidelines for installation of the models are included. The Ooms and DEGADIS models are listed along with certain program variables and diagnostic messages.

49501 **(PB—88-202809/XAB) Health-hazard evaluation report HETA-87-207-1845, University of Colorado, Health Science Center, Denver, Colorado.** Nichting, A.T.; Hales, T.R.; Gunter, B.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Oct 1987. 37p. (HETA—87-207-1845). NTIS, PC A03/MF A01.

A study of possible hospital employee exposure to ethylene oxide was undertaken. Employees had complained of headaches and possible neurological problems. A personal breathing-zone sample collected from the sterilizer operator showed levels of ethylene oxide at the limit of quantitation, 0.02mg/cu m. In sterilizer and mechanical-access-room samples, ethylene oxide was detected ranging up to 0.2mg/cu m levels. The authors conclude that a potential for exposure to ethylene oxide exists for workers in the sterilizer room. The authors recommend that efforts be continued to keep ethylene oxide levels as low as possible and to check for possible leaks in the system. Effective ventilation controls should be established, and a warning system should be installed in the mechanical access room. Respirators, protective clothing, training for employees, safety meetings, and medical evaluations for personnel were all included in the recommendations following the investigation.

49502 **(PB—88-203682/XAB) Health-hazard evaluation report HETA-84-288-1847, Wheel Trueing Tool Company, Columbia, South Carolina.** Salisbury, S.A.; Seligman, P.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Nov 1987. 40p. (HETA—84-288-1847). NTIS, PC A03/MF A01.

An investigation was made of possible exposures to chemicals and metal powders during the manufacturing of diamond-studded and diamond-impregnated cutting tools. Employees registered complaints of gastrointestinal, neurological, cardiovascular, respiratory problems, skin rashes, and a metallic taste in their mouths. Four of the 37 air samples collected showed cobalt levels exceeding the 0.1mg/m³ limit established by OSHA. Six samples revealed the presence of nickel, three of which exceeded the 0.015mg/m³ NIOSH recommended limit. Excessive graphite levels were detected. No evidence of hard metal disease or mixed dust pneumoconiosis was found. The authors conclude that there is a hazard from exposure to cobalt, nickel, and graphite dust. The authors recommend measures to reduce and monitor worker exposures to cobalt and to establish a medical monitoring program for all cobalt exposed workers.

49503 (PB—88-203724/XAB) Health-hazard evaluation report HETA-85-072-1850, Seattle Public Schools, Seattle, Washington. Kominsky, J.R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Nov 1987. 32p. (HETA—85-072-1850). NTIS, PC A03/MF A01.

An investigation was made of possible polychlorinated-biphenyl (PCB) contamination. Ballast burnouts had occurred in three classrooms at a school, resulting in high concentrations of PCBs in the air and on surfaces in these rooms. PCB concentrations ranged from 0.19 to 2.4 micrograms/100 square centimeters (microg/100 cm2) in surface samples. Air samples showed PCB concentrations ranging from 0.8 to 1.2 micrograms/cubic meter (microg/m3). The author concludes that the contamination does not present an immediate health risk to students or faculty. Recommendations are offered for the proper cleanup procedure to follow when a PCB-containing ballast fails.

49504 (PB—88-203765/XAB) Health-hazard evaluation report HETA-87-222-1849, New Mexico State Highway Department, general office building and annex, Santa Fe, New Mexico. Kominsky, J.R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Nov 1987. 12p. (HETA—87-222-1849). NTIS, PC A03/MF A01.

A 1-year follow-up test was conducted at a building that had been contaminated with polychlorinated-biphenyls (PCBs), polychlorinated dibenzofurans, and polychlorinated dibenzo-p-dioxins during a transformer fire. After substantial work, the building had been declared safe for reoccupancy. The investigation was intended to determine whether significant changes had occurred since the building was reopened. Two air samples were collected in the intake vents for the building and showed no evidence of PCB contamination from the outside air. Of the 23 samples collected inside the building in the various workspaces, all the PCB concentrations were significantly below the reoccupancy criteria of 0.4microg/cu m. The author concludes that the buildings are safe for occupancy, and further environmental testing will not be necessary.

49505 (PB—88-203773/XAB) Health-hazard evaluation report HETA-87-365-1848, Memorial Hospital of Southern Oklahoma, Ardmore, Oklahoma. Gunter, B.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Nov 1987. 13p. (HETA—87-365-1848). NTIS, PC A03/MF A01.

See also PB—87-204938.

An evaluation was made of possible worker exposure to ethylene oxide during equipment sterilizing procedures in a hospital. Levels of ethylene oxide in three of the general room air samples exceeded the OSHA permissible level of 2.0 microg/cu m. Breathing-zone samples were below the limit of detection for ethylene oxide. High levels of ethylene oxide resulted from an inadequate exhaust ventilation rate during an aborted cycle and the fact that the drain pipe from the sterilizer was not enclosed sufficiently in the floor drain and did not have a local exhaust hood built over it. The author concludes that although these workers are not overexposed to ethylene oxide by NIOSH criteria, there is a possibility of overexposure occurring if a worker goes into the sterilizer room during either an aborted or normal cycle. The author recommends that the problems with the ventilation of the floor drain in the sterilizer room be addressed.

49506 (PB—88-203849/XAB) Health-hazard evaluation report HETA-87-281-1854, Litteken Dental Clinic, Ardmore, Oklahoma. Gunter, B.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Dec 1987. 14p. (HETA—87-281-1854). NTIS, PC A03/MF A01.

An investigation was made of possible hazardous exposures to mercury and nitrous oxide at a dental clinic. Air samples were taken while the dentist and assistants used mercury amalgams. Nitrous-oxide was in use for over three hours. The air-sampling results revealed a range of nitrous-oxide concentrations in the room air from 30 to 220 parts per million (ppm). Mercury concentrations ranged from nondetectable to 0.009ppm, well below the evaluation criteria of 0.05ppm. The author concludes that a health hazard from excessive exposures to nitrous oxide exists, but mercury levels pose no health hazard in the clinic. The author recommends that the ventilation system should be adjusted each time nitrous oxide is going to be used. Routine maintenance checks should be performed on all anesthetic and suction equipment. The installation of a large fan on the roof of the building is suggested. Patients, particularly children, should be watched so that they do not play with the face mask during the administration of nitrous oxide.

49507 (PB—88-204490/XAB) Health-hazard evaluation report HETA-86-445-1831, Aluminum Company of America, Lafayette, Indiana. Hartle, R.W. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Sep 1987. 29p. (HETA—86-445-1831). NTIS, PC A03/MF A01.

In response to a request from employees at the Aluminum Company of America, an evaluation was made of potential exposure to polychlorinated biphenyls (PCBs) during the extrusion-press operation. Hydraulic fluids used in the running of these presses contained PCBs. The hydraulic and coolant lines and pumps required maintenance both internally and below the presses where there was a series of catacombs containing the equipment. These areas were typically soaked with the hydraulic and coolant fluids. While some of these concentration levels exceeded the NIOSH recommended exposure limit (1 microgram/cubic meter), serum PCB levels (nondetectable to 15.9 nanograms/milliliter) were not above those of the normal nonoccupationally exposed population. The author concludes that the levels of PCBs presents a potential hazard. The author recommends the use of personal protective clothing and decontamination of the area.

49508 (PB—88-204615/XAB) Health-hazard evaluation report HETA-86-125-1853, Empire-Detroit Steel Division, Mansfield, Ohio. Ahrenholz, S.H. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Nov 1987. 32p. (HETA—86-125-1853). NTIS, PC A03/MF A01.

See also PB—85-181329.

In response to a request from Local 169, United Steel Workers of America, an evaluation was made of vapors in the Cold Rolling Mill of Empire-Detroit Steel Division in Mansfield, Ohio. Another concern was the possible accumulation of acid vapors accumulating in the crane areas from an adjacent pickling operation. Bulk samples of coolants were taken as obtained from the supplier and as used as emulsions at the facility, for analysis. A large number of hydrocarbons were released on heating the coolants. Sampling of area air space revealed kerosene, at nondetectable to 6.1mg/m3 levels, and oil mists from nondetectable to 0.3mg/m3. Acrolein, a potential degradation product, was not detected in any sample, while formaldehyde ranged in concentration from 0.004 to 0.06mg/m3. No sulfuric acid was detected and hydrochloric acid was detected in only one sample at 0.7mg/m3. Personal breathing-space samples contained kerosene ranging from not detectable to 6.7mg/m3. No evidence to support crane operator exposure to acid mists was found. The author concludes that no chemical exposure representing a health hazard to the workers has been identified.

49509 (PB—88-204623/XAB) Health-hazard evaluation report HETA-86-524-1851, Four Wheel Drive Corportion, Clintonville, Wisconsin. Matte, T.; Almaguer, D. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Nov 1987. 40p. (HETA—86-524-1851). NTIS, PC A03/MF A01.

Exposures to welding fumes, paint, and asbestos among workers were evaluated. Workers had complained of respiratory and other health problems. Total airborne welding-fume concentrations collected near welders ranged from 0.7 mg/m^3 to 6.2 mg/m^3. Concentrations of nickel ranged from 0.001 to 0.022 mg/m^3. Silver was detected in only one sample. Airborne-asbestos concentrations were below the limit of detection. Analysis of brake shoe shavings showed that they contained 10 to 20% chrysotile asbestos. The authors conclude that there is a health hazard from exposure to welding fume, and that a potential for exposure to asbestos exists in the brake shoe machining area. The authors recommend improvements in ventilation, use of respiratory protective equipment, and engineering controls.

49510 **(PB—88-204672/XAB) In-depth survey report: high-velocity low-volume exhaust of manual sanding operations at Navistar, Columbus Plastics Plant, Columbus, Ohio.** O'Brien, D.M.; Cooper, T.C.; Gressel, M.G.; Martinez, K.F.; Todd, W.F. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Physical Sciences and Engineering). Feb 1988. 25p. (ECTB—167-11B). NTIS, PC A03/MF A01.

The sheet-molding-compound process shares one problem with other reinforced-plastic processes: potentially high exposures to fibrous glass and plastic dusts from extensive manual trimming and finishing operations. The report concerns an evaluation of dust controls (tool-mounter, high-velocity, low-volume exhaust hoods) for hand-held sanders and routers at the Columbus Plastics Plant of Navistar.

49511 **(PB—88-204680/XAB) In-depth survey report: evaluation of brake-drum service controls at Cincinnati Gas and Electric Garages, Cincinnati, Evanston, and Monroe, Ohio and Covington, Kentucky.** Cooper, T.C.; Sheehy, J.W.; O'Brien, D.M.; McGlothlin, J.D.; Todd, W.F. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jan 1988. 32p. (ECTB-CT—152-22B). NTIS, PC A03/MF A01.

Methods used to control asbestos release from brake linings during brake servicing jobs were evaluated at Cincinnati Gas and Electric garages in Ohio and Kentucky. Air samples and general-work-practice evaluations were made at four of ten garages during brake jobs on six different vehicles to determine whether dust-control measures in use were sufficient to limit the potential for exposure to asbestos dust to workers. A solvent spray was used to suppress brake dust, being applied to all exposed surfaces after the brake drum has been removed. In one garage a mechanic applied the solvent by the wet-brush method, while in the other garages the solvent was sprayed on the exposed surfaces. Asbestos concentrations in personal samples for the five vehicles having brake drums less than or equal to 12 inches in diameter was 0.046 fibers/cubic centimeter (f/cc). The greatest potential exposure occurred during spraying of brake components and drums. The second-highest dust levels occurred during loosening and tightening of lug bolts with a pneumatic air wrench. The study demonstrates the effectiveness of the wet spray and wet brush methods for containing asbestos exposures.

49512 **(PB—88-207386/XAB) Vehicle emissions and their environmental impact: the image presented by swedish mass media.** Perby, H. (Statens Vaeg- och Trafikinstitut, Linkoeping (Sweden)). 1988. 20p. (In Swedish). (VTI/MEDDELANDE—563). NTIS, PC E03/MF A01.

The investigation used as a basis 250 articles and features on traffic and its environmental impact published by Swedish mass media (newspapers, periodicals, radio, television and news agencies) during May to November 1987. The media presented a very clear image of the effects of emissions from vehicles on organisms. The subject is often discussed in lead stories and editorials, which indicates that the issue has become established in the central political debate. The opinions of the environmentalist movement occupy a strong position in the mass media. The dominating view on improved road standards is that speed and traffic volume and consequently the emissions of pollutants increase. The media focus on the quantitative aspects of emissions while, the biological and chemical aspects are only discussed superficially.

49513 **(PB—88-213020/XAB) Control and mitigation systems for accidental releases of toxic chemicals.** Krishnan, E.R.; Utrecht, P.W.; Bare, J.C. (PEI Associates, Inc., Cincinnati, OH (USA)). May 1988. 18p. NTIS, PC A03/MF A01.

The paper discusses control and mitigation systems for accidental releases of toxic chemicals. A review of the control/mitigation system data base developed during an EPA study reveals that the major control measure employed by industry for accidental releases is routine process inspections. For control devices, flares and scrubbers were found to be the control systems of choice for handling such releases. The types of accidental-release control systems appear to be chemical-specific, although insufficient data were available per chemical to establish trends for different chemicals. The mitigation systems data base revealed a variety of techniques (e.g., water misting, dikes, foam covers) in industry for limiting the spread of an accidental release. The limited data base did not allow any clear trends to be established for mitigation systems by type of chemical. The control/mitigation system data base also pointed out that companies viewed improved inspections and equipment testing as the best way to prevent accidental releases.

49514 **(PB—88-213624/XAB) Fiscal year 1986 summary report of NOAA (National Oceanic and Atmospheric Administration) Meteorology Division support to the Environmental Protection Agency. Technical memo.** Viebrock, H.J.; Poole-Kober, E.M. (National Oceanic and Atmospheric Administration, Silver Spring, MD (USA). Air Resources Lab.). Feb 1988. 64p. (NOAA-TM-ERL-ARL—162). NTIS, PC A04/MF A01.

See also PB—88-179866.

The Meteorology Division provided meteorological research and operational support to the U.S. Environmental Protection Agency. Basic meteorological operational support consisted of the application of dispersion models, and the conduct of dispersion studies and model evaluations. The primary research effort was the development and evaluation of air quality simulation models using numerical and physical techniques supported by field studies. Highlights during FY-1986 included preliminary evaluation of a regional acid deposition model; conduct of a mesoscale acid deposition field study near Philadelphia, PA; completion of the RELMAP user's guide; conduct of terrain studies in the Fluid Modeling Facility; development of a new model for the autocorrelation function of wind components; completion of preparations for the Integrated Air Cancer Program field study; and release of UNAMAP Version 6.

49515 **(PB—88-214804/XAB) Sample-accountability quality assurance for the Integrated Air Cancer Project research program of the US Environmental Protection Agency.** Watts, R.R.; Cupitt, L.T. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). 1987. 6p. (EPA—600/J-87/347). NTIS, PC A02/MF A01.

Jnl. of the Association of Official Analytical Chemists, Vol. 70, No. 6, 1069-1072(1987).

A sample-accountability quality-assurance (QA) program is described for a field and laboratory research effort which resulted in collection of approximately 2000 samples for analysis by several EPA and contractor laboratories. A QA program was specifically developed for this research program to include sample transfer from collection site to storage maintenance, record development, transfer to researchers, and sample tracking at all stages. A sample-identification system and sample custody records are described for field and laboratory application. The functions of a sample coordinator are also described as relating to sample custody, coordination of sample analysis with researchers, and development of computer record files to facilitate research and sample tracking.

49516 **(PB—88-214911/XAB) EPA/NOAA/NASA/USDA N_2O workshop. Volume 1. Measurement studies and combustion sources, September 15-16, 1987, Boulder, Colorado. Report for June 1987-April 1988.** Kramlich, J.C.; Lyon, R.K.; Lanier, W.S. (Energy and Environmental Research Corp., Irvine, CA (USA)). May 1988. 84p. NTIS, PC A05/MF A01.

See also PB—87-113742.

The report documents activities during a portion of the second workshop on atmospheric nitrous oxide (N_2O) at Boulder, Colorado, on September 15-16, 1987. Among workshop goals were: to provide an opportunity for a more timely exchange of information among researchers than would otherwise be possible through normal technical channels; to prioritize the research that is needed to determine if atmospheric N_2O is a problem; and to understand the importance of various sources and sinks. The technical discussion involved three areas: (1) measurement approaches, (2) combustion sources of N_2O, and (3) biogenic sources of N_2O. Within each area, the focus was on using the best current understanding to develop the research priorities needed to assess the severity of the

N_2O problem. The volume focuses on the first two areas; Volume II is to focus on the third.

49517 **(PB—88-214937/XAB) Flares as a means of destroying volatile organic and toxic compounds. Report for 1980-1987.** McCrillis, R.C. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). May 1988. 28p. (EPA—600/D-88/106). NTIS, PC A03/MF A01.

The paper discusses the use of flares to destroy volatile organic and toxic compounds. Flares are used to destroy industrial gases from which the heating cannot be economically recovered. Results of an EPA investigation of overall flare combustion efficiency and specific compound destruction efficiency, using a large pilot scale facility built in 1982, show that, for the gases tested, combustion and destruction efficiencies are above 98% if the ratio (lower heating value of gas being flared)/(minimum lower heating value required for stable combustion) is greater than 1.2. If this stability ratio falls below 1.2, the efficiencies fall rapidly, reaching zero when the flame goes out. The results also show that the stability limit is strongly influenced by the velocity and lower heating value of the gas leaving the flare tip and the design of the flare tip. A pilot flame can improve stability by extending the stable combustion regime to lower values of the lower heating value. Air and steam assist, used to reduce smoking, can affect combustion efficiency only if the assist gas flow rate is excessive.

49518 **(PB—88-214945/XAB) Emissions of metals and organics from four municipal waste-water sludge incinerators: preliminary data.** Bostian, H.E.; Crumpler, E.P.; Palazzolo, M.A.; Barnett, K.W.; Dykes, R.M. (Radian Corp., Research Triangle Park, NC (USA)). May 1988. 31p. NTIS, PC A03/MF A01.

See also PB—86-123569.

The paper presents preliminary results from a U.S. EPA test program on municipal waste-water sludge incinerators. The major objectives of the program were the following: (1) collecting data that allow a comparison of metals and organic compound emissions during steady-state and transient incinerator operation, (2) evaluating scrubber removal efficiencies for specific compounds, and (3) establishing cause and effect relationships between incinerator operating conditions and emissions. The technical approach first involved selection of appropriate test sites. Three sites with multiple hearth incinerators and one site with a fluidized-bed incinerator were selected. Sampling and analysis plans were then prepared for the overall project and for each specific site. At the time of preparation of the paper, testing at all four sites had been completed. Reported here are preliminary compilations of data and associated analyses that are now available.

49519 **(PB—88-214952/XAB) Destruction of air emissions using catalytic oxidation.** Kosusko, M.; Ramsey, G.M. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). May 1988. 29p. (EPA—600/D-88/107). NTIS, PC A03/MF A01.

See also PB—88-106166.

This paper discusses key emission stream characteristics and hazardous air pollutant (HAP) characteristics that affect the applicability of catalytic oxidation as an air pollution control technique in which volatile organic compounds (VOCs) and vapor-phase air toxics in an air emission stream are oxidized with the help of a catalyst. Design of catalytic systems for control of point-source emissions is based on stream-specific characteristics and desired control efficiency. The application of catalytic oxidation to four types of air emission sources is discussed: groundwater stripping operations, graphics arts (heatset printing) facilities, flexographic printing plants, and latex monomer production. The characteristics of each emission are discussed along with the catalytic technology used to control it. In addition, several catalytic systems are identified for control of air emissions, along with information about their technology and their position in the market place. Finally, some rough economics are presented which compare catalytic oxidation, carbon adsorption, and thermal incineration systems.

49520 **(PB—88-215678/XAB) Sources and concentration of chloroform emissions in the South Coast Air Basin. Final report. Report for August 1985-May 1987.** Rogozen, M.B.; Rich, H.E.; Guttman, M.A.; Grosjean, D.; Williams, E.L. (Science Applications International Corp., Manhattan Beach, CA (USA)). 8 Apr 1988. 386p. (SAIC—86/1105). NTIS, PC A17/MF A01.

See also PB—87-168688.

The objectives of the study were to identify and quantify sources of chloroform emissions in the South Coast Air Basin, and to relate emissions to ambient concentrations. Phase I consisted of a literature review; written and telephone surveys of users of chloroform precursors (water and waste-water-treatment plants, cooling-tower users, pulp and paper plants, pharmaceutical manufacturers, laboratories, and hospitals); and modeling to relate estimated emissions to historically observed concentrations. A machine-readable annotated bibliography was also developed. Phase II included ambient sampling by carbon molecular sieves at sites throughout the Basin and at two fixed sites; source testing of a swimming pool (using a surface isolation flux chamber) and at two waste-water treatment plants; sampling of marine air and water; and smog chamber modeling of hypothesized atmospheric formation and removal processes. New emissions estimates were developed from field measurement data and the resulting modeled concentrations fit the observed values reasonably well. A conceptual model of cycling of chloroform between the ocean and the atmosphere over the Basin was proposed.

49521 **(PB—88-215876/XAB) Lifetimes and fates of toxic chemicals in California's atmosphere. Final report, 29 January 1986-31 October 1987.** Winer, A.M.; Atkinson, R.; Arey, J.; Aschmann, S.M.; Goodman, M.A. (California Univ., Riverside (USA). Statewide Air Pollution Research Center). Aug 1987. 165p. NTIS, PC A08/MF A01.

See also PB—85-138626.

The kinetics and/or the products of the gas-phase reactions of Hydroxyl (OH) radicals, ozone (O_3), and nitrate (NO_3) radicals with ethylene oxide, vinyl chloride, 1,1-dichloroethene, cis- and trans-1,2-dichloroethene, trichloroethene, tetrachloroethene, acrolein, allyl chloride, benzyl chloride, o-,m- and p-cresol, naphthalene, 1,4-benzodioxan and 2,3-dihydrobenzofuran were experimentally investigated. These kinetic data were used to calculate corresponding atmospheric lifetimes for each compound, for the three possible reaction pathways. None of the compounds investigated react sufficiently fast with O_3 under atmospheric conditions for the process to represent a significant atmospheric removal pathway. Where feasible, product studies were conducted, principally using in situ Fourier transform infrared spectroscopy and gas chromatography, to determine the atmospheric reaction products produced from the parent compounds investigated. The OH radical rate constant data obtained in the program were combined with available literature data in order to further develop appropriate structure-reactivity relationships.

49522 **(PB—88-216684/XAB) Direct reduction of sulfur dioxide to elemental sulfur.** Henderson, I. (Council for Mineral Technology, Randburg (South Africa)). 10 Mar 1988. 32p. (MINTEK-M—346). NTIS, PC E03/MF A01.

A major problem with reduction of sulfur dioxide is the simultaneous production, at high conversions of the gas, of significant quantities of contaminants such as hydrogen sulfide and carbonyl sulfide. The report describes tests in which char from Rand Carbide is used to produce a gas stream comprising 20% SO_2 in nitrogen. Although conversions of up to 90% can be achieved without production of contaminants, passivation of char is a potential problem and higher temperatures are required to achieve high conversion of SO_2 with char that has been partly utilized.

49523 **(PB—88-218284/XAB) Directory of Precipitation Monitoring Sites. National Atmospheric Deposition Program/National Trends Network (NADP/NTN). Volumes 1 and 2.** Robertson, J.K.; Wojciechowski, D. (National Acid Precipitation Assessment Program, Washington, DC (USA)). Nov 1986. 985p. NTIS, PC A99.

The Directory of Precipitation Monitoring Sites contains a four-page description of each of the atmospheric precipitation-monitoring sites that has operated or was operating as part of the National Atmospheric Deposition Program/National Trends Network (NADP/NTN) on July 1, 1986. Each site description contains information, including photographs and maps. Volume 1 contains introductory material, location maps, and sites with State abbreviations in the range from A - M.

49524 **(PB—88-218375/XAB) Numerical simulation of three-dimensional tuft corona and electrohydrodynamics.** Yamamoto, T.; Sparks, L.E. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). 1986. 8p. (EPA—600/J-86/464). NTIS, PC A02/MF A01.

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Industry Applications, Vol. 1A-22, No. 5, 880-885(Sep-Oct 1986).

The numerical simulation of three-dimensional tuft corona and electrohydrodynamics (EHD) is discussed. The importance of high-voltage and low-current operation in the wire-duct precipitator has focused attention on collecting high-resistivity dust. The local current density of individual tufts is considerably higher even at a low average current level and, therefore, could contribute to both the formation of back corona in the collected-dust layer and the generation of the secondary flow. Numerical simulation for three-dimensional tuft corona is successfully solved. The electrical characteristics of tuft corona are investigated, and the structure and role of the three-dimensional secondary flow and EHD in relation to transport of the fine particles are described.

49525 **(PB—88-218433/XAB) Receptor-modeling results from the Integrated Air Cancer Project.** Lewis, C.W.; Stevens, R.K.; Baumgardner, R.E.; Zweidinger, R.B.; Cupitt, L.T. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). Jun 1988. 9p. (EPA—600/D-88/127). NTIS, PC A02/MF A01.

EPA's Integrated Air Cancer Project has produced comprehensive winter-time ambient-air data bases from three widely separated airsheds (Albuquerque, NM, Raleigh, NC, Boise, ID), which were anticipated to be heavily impacted by residential woodsmoke and motor-vehicle emissions, but little else. Because of the simplicity of the airsheds, a relatively simple multiple linear regression method using tracers based on potassium and lead or bromine was successful in apportioning ambient fine-particle extractable organics and mutagenicity. A comparison of receptor-modeling results from all three cities shows a general consistency between the three cities, and with earlier mutagenic potency measurements from direct source testing.

49526 **(PB—88-220223/XAB) Investigation of 2,4-dinitrophenylhydrazine impregnated adsorbent tubes for the collection of airborne aldehydes.** Holdren, M.W.; Smith, D.L.; Russell, N.K. (Battelle Columbus Div., OH (USA)). Jun 1988. 53p. NTIS, PC A04/MF A01.

The objective of the study was to investigate the use of 2,4-dinitrophenylhydrazine (DNPH) impregnated adsorbents for sampling airborne aldehydes. Experimental results using a 17 cu m environmental chamber and various spiked amounts of aldehyde material (low ppb levels) showed that the DNPH coated cartridge and the DNPH/acetonitrile impinger methods gave equivalent results. Blank levels of the DNPH-coated cartridges were studied as a function of storage time using various containers and temperature conditions. Canisters pressurized with zero-grade nitrogen provided the best storage device. Lower blank levels were also obtained when the cartridges were stored at lower temperatures. Blank levels appear to equilibrate after six days of storage. To assure that quality data will be obtained, cartridges should be grouped according to batch number and blank levels should be determined prior to any field monitoring effort. Blank cartridge levels should be an order of magnitude lower than sample cartridge level. High performance liquid chromatography with UV detection proved to be a sensitive and stable analytical method for the DNPH derivatives.

49527 **(PB—88-866389/XAB) Indoor air pollution: sources and control. January 1970-June 1988 (Citations from the NTIS data base). Report for January 1970-June 1988.** (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 193p. NTIS PC N01/MF N01.

Supersedes PB—87-851754.

This bibliography contains citations concerning indoor air pollution in residential, commercial, industrial, and institutional buildings. Indoor air-quality assessment, health hazard evaluation, contaminant identification and measurement are discussed. Indoor air pollution control methods and equipment are evaluated. Air-quality analyses of energy-efficient buildings are presented. Indoor air pollution from radon and asbestos are discussed in other bibliographies. (This updated bibliography contains 299 citations, 56 of which are new entries to the previous edition.)

49528 **(PB—88-866397/XAB) Asbestos removal. January 1970-June 1988 (Citations from the NTIS data base). Report for January 1970-June 1988.** (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 70p. NTIS PC N01/MF N01.

Supersedes PB—87-855334.

This bibliography contains citations concerning methods of removing asbestos from buildings and water. Walk-through survey reports describe wet- and dry-removal techniques being employed at work sites. Containment barriers, ventilation systems, and vacuum systems used during asbestos-removal projects are also described. Monitors that measure asbestos dust fibers, and water filters that remove asbestos are also discussed. Alternative uses in highways and as an absorbing agent in oil spill cleanups are explored along with disposal methods. (This updated bibliography contains 91 citations, 11 of which are new entries to the previous edition.)

49529 **(PB—88-866637/XAB) Air-pollution emission factors. August 1986-July 1988 (Citations from the NTIS data base). Report for August 1986-July 1988.** (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 85p. NTIS PC N01/MF N01.

Supersedes PB—87-865192.

This bibliography contains citations concerning emission factors for a variety of industrial, stationary, and mobile sources. Emissions inventories are discussed in terms of specific compounds, as well as by source type. Computer simulations utilizing emission factors in air-pollution impact studies are also included. (This updated bibliography contains 128 citations, 50 of which are new entries to the previous edition.)

49530 **(PB—88-866645/XAB) Gas scrubbers used in pollution control. January 1979-July 1987 (Citations from the Engineering Index data base). Report for January 1979-July 1987.** (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 160p. NTIS PC N01/MF N01.

This bibliography contains citations concerning particle and gas scrubbers. Topics include design aspects, performance evaluations, gas flow analyses, and pollutant chemistry. Pollution control of SO_2, NOX, CO, CO_2, hydrocarbons, and particulates is discussed. (This updated bibliography contains 399 citations, none of which are new entries to the previous edition.)

49531 **(PB—88-866652/XAB) Gas scrubbers used in pollution control. August 1987-July 1988 (Citations from the Engineering Index data base). Report for August 1987-July 1988.** (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 35p. NTIS PC N01/MF N01.

Supersedes PB—87-865127.

This bibliography contains citations concerning particle and gas scrubbers. Topics include design aspects, performance evaluations, gas flow analyses, and pollutant chemistry. Pollution control of SO_2, NOX, CO, CO_2, hydrocarbons, and particulates is discussed. (This updated bibliography contains 57 citations, all of which are new entries to the previous edition.)

49532 (UCID—21333) CHAWS [Chemical HAzard Warning System] user's guide: System description and standard operating procedures, Pine Bluff Arsenal. Shinn, J.H.; Novo, M.G. (eds.). (Lawrence Livermore National Lab., CA (USA)). Mar 1988. Contract W-7405-ENG-48. 183p. NTIS, PC A09. Order Number DE88014313/JAW.

The Chemical HAzard Warning System (CHAWS) has been designed to collect meteorological data and to display, in real time, hazardous chemical dispersion as a result of an accidental release. Meteorological sensors are placed strategically around each installation and are used to calculate direction and hazard distance for the release. These data are then graphically displayed on a computer screen showing a site map and arrows depicting the release direction and distance traveled. The objectives of CHAWS are as follows: to determine the trajectory of the center of mass of released material from the measured wind field; to calculate the dispersion based on the measured lateral turbulence intensity (sigma theta); to determine the height of the mixing zone by measurement of the inversion height and wind profiles up to an altitude of about 1 km; to archive meteorological data for potential use in climatological descriptions for emergency planning; to archive air-quality data for preparation of compliance reports; and to provide access to the data for realtime hazard analysis purposes. The system is discussed.

49533 (UCID—21335) CHAWS [Chemical HAzard Warning System] user's guide: System description and standard operating procedures, Edgewood area, Aberdeen Proving Ground. Shinn, J.H.; Novo, M.G. (eds.). (Lawrence Livermore National Lab., CA (USA)). Mar 1988. Contract W-7405-ENG-48. 172p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88014312/JAW.

The Chemical HAzard Warning System (CHAWS) has been designed to collect meteorological data and to display, in real time, hazardous chemical dispersion as a result of an accidental release. Meteorological sensors are placed strategically around each installation and are used to calculate direction and hazard distance for the release. These data are then graphically displayed on a computer screen showing a site map and arrows depicting the release direction and distance traveled. The objectives of CHAWS are as follows: To determine the trajectory of the center of mass of released material from the measured wind field. To calculate the dispersion based on the measured lateral turbulence intensity (sigma theta). To determine the height of the mixing zone by measurement of the inversion height and wind profiles up to an altitude of about 1 km. To archive meteorological data for potential use in climatological descriptions for emergency planning. To archive air-quality data for preparation of compliance reports. To provide access to the data for realtime hazard analysis purposes. The system and programs are described.

49534 (UCID—21456) CHAWS [Chemical HAzard Warning System] message center users guide: System description and operating procedures, Pine Bluff Arsenal. Martins, S. (Lawrence Livermore National Lab., CA (USA)). May 1988. Contract W-7405-ENG-48. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014216/JAW.

The Chemical HAzard Warning System (CHAWS) has been installed at Pine Bluff Arsenal to collect meteorological data and to display, in near-real time, hazardous chemical dispersion as a result of an accidental release. The CHAWS central computer is located in the Operations Center (OC). In order to facilitate communications of meteorological data and emergency information, the Pine Bluff Message Center system was developed by the Lawrence Livermore National Laboratory as an adjunct to CHAWS. The system is comprised of a number of separate but interrelated computers, software, and peripheral devices. Many local and remote users access information in the message center at any given time. The system is described.

49535 (UCRL—98893) HCL measurements in space vehicle exhaust clouds. Smith, M.D.; McRae, T.; Kennedy, R.; Garvis, D.; Kulp, T.; Berstein, L.S.; Bien, F.; Cheng, W.; Domingue, R.P.; Richtmeier, S.C. (Air Force Civil Engineering Center, Tyndall AFB, FL (USA); Lawrence Livermore National Lab., CA (USA); Spectral Sciences, Inc., Burlington, MA (USA)). 1988. Contract W-7405-ENG-48. 11p. (CONF-8805173—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013815/JAW.

From JANNAF Safety and Environmental Protection Subcommittee meeting; Monterey, CA, USA (23 May 1988).

The United States Space Program requires the use of large launch vehicles like the space shuttle, Titan 34D, Titan IV, and the proposed heavy-lift vehicle. These large launch systems utilize solid rocket motors to place heavy payloads into orbit. However, most solid rocket motors utilize ammonium perchlorate as an oxidizer and release an exhaust cloud, which is a dynamic mixture of water, hydrogen chloride, aluminum oxide, and aluminum chloride. Described in this presentation are two infrared monitors which are designed for HCl field measurements. One monitor, developed by Lawrence Livermore National Laboratory (LLNL), measures gaseous HCl and accounts for the presence of water and methane that absorb at the HCl wavelength. A detection limit of 0.2 ppM has been demonstrated. The second monitor, developed by Spectral Sciences, Inc., uses a unique HCl lamp which is free of interferences associated with conventional black body radiation sources. By combining the lamp with simple optics, a detection limit of 0.1 ppM has been obtained. Since much of the HCl in the ground cloud is entrained in small water droplets and the infrared technique measures only gaseous HCl, a method was required to account for aqueous HCl. The Spectral Sciences monitor features a preheater which vaporizes aerosols in the input gas stream so that total HCl can be measured. For both monitors, instrument design and operation are described in detail. 11 refs., 7 figs., 2 tabs.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 49168, 49169, 49221, 49480, 49495, 49568, 49610, 49611, 49717, 49728

49536 (CONF-880906—2) New dose-mortality data based on 3-D radiation shielding calculation for concrete buildings at Nagasaki. Rhoades, W.A.; Childs, R.L.; Ingersoll, D.T. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012198/JAW.

From 7. international conference on radiation shielding; Bournemouth, UK (12 Sep 1988).

The analysis of radiation doses received during the World War II attack on Nagasaki provides an important source of biochemical information. More than 40 years after the war, it has been possible to make a satisfactory calculation of the doses to personnel inside reinforced concrete buildings by use of a 3-dimensional discrete ordinates code, TORT. The results were used to deduce a new value of the LD50 parameter that is in good agreement with traditional values. The new discrete ordinates software appears to have potential application to conventional radiation transport calculations as well. 9 refs., 3 figs., 2 tabs.

49537 (DP-MS—88-84) Meteorological measurements for emergency response. Crawford, T.V. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1988. Contract AC09-76SR00001. 33p. (CONF-880913—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88011242/JAW.

From ANS topical meeting on emergency response: planning, technologies and implementations; Charleston, SC, USA (26 Sep 1988).

The need for and role of meteorological data in support of emergency response actions are reviewed. Atmospheric boundary layer processes important to emergency response are presented as a basis for the discussion of measuring instruments and data collecting and displaying systems. Examples are given from the Savannah River Plant site in South Carolina. Accuracy, resolution, reliability,

redundancy, quality control, etc., are also discussed. 8 refs., 8 figs., 5 tabs.

49538 **(EML—497) Annual report of the Surface Air Sampling Program.** Freely, H.W.; Larsen, R.J.; Sanderson, C.G. (USDOE Environmental Measurements Lab., New York). Jul 1988. 165p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88014637/JAW.

Tropospheric concentrations of radioactive debris from nuclear weapons tests continued to decrease during the period from 1983 to 1985. For the first time since this measurement program was begun, no clear springtime peak was discernible in the concentrations of {sup 90}Sr, {sup 137}Cs, and {sup 239,240}Pu in the surface air of the Northern Hemisphere. The data for quality assurance samples measured as part of the program indicate that the low ambient concentrations during this period introduced significant uncertainties into the fission product data for routine monthly samples. Meteorological factors probably produce the large observed week to week variations in the concentrations of {sup 7}Be and {sup 210}Pb at sites that are sampled on a weekly basis. Four such factors are responsible for much of the seasonal variation of {sup 7}Be concentrations. These are variations in the rate of exchange of air between the stratosphere and the troposphere, of vertical transport within the troposphere, of horizontal mixing between high- and mid-latitudes, and of washout by rainfall.

49539 (INIS-BR—1147-Vol.3, pp 47-57) **Aerial radiometric surveying of Goiania city, Brazil, after the accident with Cs-137.** Barreto, P.M.C.; Fonseca, E.S. da. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A low altitude (40 m) aeroradiometric survey with an helicopter was carried out over Goiania city few days after the Cs-137 radiological accident was communicated to CNEN. The objective was to evaluate the extension of the contamination. All the urban area plus dwellings centers in the outskirts of the city as well as drainage systems were surveyed in two days of operation. A total of 67 million m/sup 2/ were evaluated. This survey found out only one contamination point (1.1 R/h) which was not yet identified by the ground crews. No contamination was found in the Capin Puba Creek and Meia Ponte river. Detection tests at differen heights over the main contamination points showed that Cs-137 radiation could be detected at more than 350m above them. The results demonstrated that the contamination was restricted to points in the neighbourhood of the junkyard where the source was violated. Such points were under the control of CNEN personnel. The advantages of the airbone technique was to cover a large area in short time. The non-existence of a regional contamination was an important fact to calm the population and the Government.

49540 **(PB—88-211925/XAB) Radon mitigation in crawlspace houses in Nashville, Tennessee. Report for October 1987-July 1988.** Pyle, B.E.; Williamson, A.D.; Fowler, C.S.; Belzer, F.E.; Osborne, M.C. (Southern Research Inst., Birmingham, AL (USA)). May 1988. 14p. NTIS, PC A03/MF A01.

Approximately 15% of existing U.S. houses are built over dirt crawl spaces, and little or no data exist relative to radon mitigation techniques for this style of house construction. This paper discusses and Environmental Protection Agency radon mitigation demonstration. A variety of techniques were evaluated to determine the most-effective and least-costly method of radon mitigation.

49541 **(PB—88-213178/XAB) Radiological survey of the Pearl Harbor Naval Shipyard and Environs, Honolulu, Hawaii. Final report.** Callis, R.S. (Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility). Jun 1987. 31p. (EPA—520/5-87/010). NTIS, PC A03/MF A01.

This report presents results of the survey conducted by the Eastern Environmental Radiation Facility personnel to assess levels of environmental radioactivity resulting from maintenance and operation of nuclear-powered warships at the Pearl Harbor Naval Shipyard and Environs on the Hawaiian Island of Oahu.

49542 **(PB—88-213210/XAB) Radiological survey of Charleston Naval Base and Shipyard and the Charleston Naval Weapons Station. Final report.** Smith, J.M. (Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility). Jul 1987. 22p. (EPA—520/5-87/009). NTIS, PC A03/MF A01.

This report presents results of the survey conducted by the Eastern Environmental Radiation Facility (EERF) personnel to assess levels of environmental radioactivity resulting from maintenance and operation of nuclear-powered warships at the Charleston Naval Base and Shipyard and the Charleston Naval Weapons Station, near Charleston, SC.

49543 **(PB—88-213970/XAB) Florida statewide radiation study.** Nagda, N.L.; Koontz, M.D.; Fortmann, R.C.; Schoenborn, W.A.; Mehegan, L.L. (GEOMET Technologies, Inc., Germantown, MD (USA)). 5 Nov 1987. 460p. (GEOMET-IE—1808). NTIS, PC A20/MF A01.

Florida phosphate deposits contain higher levels of uranium than most other soils and rocks, thus exposing the population to higher-than-desirable levels of radon and its short-lived daughters. The Florida Legislature ordered a survey of significant land areas where an environmental radiation standard should be applied. Among other things, the study assessed indoor radon in 6,000 homes, soil radon at 3,000 residences, and all data existing prior to the study. The report explains the purpose of the study, how it was designed and conducted, and its results. It concludes with a discussion of radon/radon decay product equilibrium factor, correlation between indoor and soil radon, and preliminary attempts to develop a safe threshold for soil radon below which few elevated indoor levels would be anticipated.

49544 **(PB—88-218979/XAB) Estimating the risk of lung cancer from inhalation of radon daughters indoors: review and evaluation. Final report, October 1986-April 1988.** Borak, T.B.; Johnson, J.A. (Colorado State Univ., Fort Collins (USA). Dept. of Radiology and Radiation Biology). Jun 1988. 131p. NTIS, PC A07/MF A01.

A review of the dosimetric models and epidemiological studies with regard to the relation between indoor radon exposure and lung cancer indicates that the Working Level is an appropriate unit for indoor radon exposure; that the uncertainty in applying risk estimates derived from uranium miner data may be reduced by determining nose vs. mouth breathing ratios, residential aerosol characteristics, and lung cancer risk vs. age at exposure; that there is persuasive evidence of an association between radon exposure indoors and lung cancer; and that epidemiological studies in progress may provide a basis for revision or validation of current models but only is experimental designs are employed that will permit pooling of data to obtain greater statistical power.

49545 **(RISO-M—2689) Investigation of factors influencing indoor radon concentrations.** Majborn, B.; Soerensen, A.; Nielsen, S.P.; Boetter-Jensen, L. (Risoe National Lab., Roskilde (Denmark)). May 1988. 58p. NTIS (US Sales Only), PC A04/MF A01 - Risoe Library, DK-4000 Roskilde. Order Number DE88754755/JAW.

Variations in indoor radon concentrations and some influencing factors have been studied during a two-year period (1986-1987) in 16 almost identical single-family houses.The annual average radon concentration in the houses varied from about 50 to about 400 Bq/m/sup 3/. Variations in soil characteristics and radon concentration in soil gas could not be directly related to the variations of the average indoor radon concentrations. Most of the houses showed a "normal" seasonal variation of the radon concentration with a maximum in the winter and minimum in the summer. A deviating seasonal variation was found in three of the houses. Hourly data obtained in one unoccupied house during a period of 2-1/2 months showed no or only weak correlations between the indoor radon concentration and meteorological factors. However, for most of the houses, the seasonal variation of the indoor radon concentration was well correlated with the average indoor-outdoor tempera-

ture difference on a 2-month basis. It was demonstrated that the radon concentration can be strongly reduced in the Risoe houses if a district-heating duct, which is connected to all the houses, is ventilated, so that a slightly lowered pressure is maintained in the duct. 5 taps., 24 ill.

5005 Site Resource And Use Studies

49546 (UCRL—21077) Wind tunnel study of Lawrence Livermore National Laboratory NDERF building. Stein, W.; White, B.R.; Strataridakis, C.J.; Kavanagh, J.; Kim, S.; Mounla, H. (Lawrence Livermore National Lab., CA (USA)). Apr 1988. Contract W-7405-ENG-48. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88015428/JAW.

An experimental wind-tunnel study of the proposed NDERF building including the proposed exhaust stack was carried out. Smoke tracer techniques were employed to identify the wake and vortex shedding that was caused by the upstream edges or corners of the building. The data was used to determine a stack height required for the stack outlet to be free of the upstream wake effects. Smoke tracer experiments involving smoke emitted form the stack also we conducted to identify the downwind dispersion of the smoke plume. Results from this data indicated if stack exhausts impacted upon the building roof or the downwind distance required for the plume to reach groundlevel. An atmospheric wind tunnel was used to conduct the experiments. The tunnel flow boundary layer was conditioned to be a mature turbulent flow which simulated the velocity and turbulence intensity profiles as measured at the proposed building site. A 1:3000 scale model of the building and its surroundings was placed in the tunnel and experiments were carried out to represent wind directions from the north, south, east, west, northwest and southeast. Two different stack locations and three different stack heights were used in the experiments. Experimental flow conditions represent a full scale wind velocity of 11 m/s (25 mph) at a height of 40m. The smoke tracer experiments were recorded on video tape for later analysis. Results show that, for an east or west wind the exhaust from a 45.5 m high stack (2.5 building heights off the ground) will not be affected by upstream wake effects and also the exhaust plume will not contact the building roof for either of the two stack locations investigated. 8 refs.

5006 Regulations

REFER ALSO TO CITATION(S) 48701, 48762, 48825, 49574, 49620

49547 (EML—513) Semi-annual report of the Department of Energy, Operational Safety, Health and Environment Division: Quality assessment program. Sanderson, C.G.; Feiner, M.S. (USDOE Environmental Measurements Lab., New York). 1 Jul 1988. 93p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88014636/JAW.

This report presents the results from the analysis of the 28th set of environmental quality assessment samples (QAP XXVIII) that were received on or before June 7, 1988. This Quality Assessment Program (QAP) is designed to test the Quality of the environmental measurements being reported to the Department of Energy by its contractors. Since 1976, real or synthetic environmental samples that have been prepared and thoroughly analyzed at the Environmental Measurements Laboratory (EML) have been distributed, at first Quarterly and then semiannually to these contractors. Their results, which are returned to EML within 90 days, are compiled with EML's results and are reported back to the participation contractors 30 days later. A summary of the reported results is available to the participants 3 days after the reporting deadline via a modem-telephone connection to the EML computer.

49548 (NP—8770308) Development and use of a method to compare air quality standards. Rev. Ed. Muench, J.; Mueller, H.G. (Dornier-System G.m.b.H., Friedrichshafen (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.)). May 1985. 212p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88770308/JAW.

Development of a model for statistical distribution and the influence of averaging time of air quality data. The model approximately transforms air quality standards to a comparison base. The comparibility of further regulation e.g. legal basis of the standards and monitoring techniques are also controlled. The SO/sub 2/-standards of EEC, USA and FRG were compared with this method, for example.

49549 (PB—88-211743/XAB) Performance of certified wood stoves under field conditions. Report for August 1985-September 1987. Burnet, P.G.; McCrillis, R.C.; Morgan, S.J. (CONEG Policy Research Center, Inc., Washington, DC (USA)). May 1988. 13p. NTIS, PC A03/MF A01.

This paper discusses the monitoring of wood-stove performance under field conditions in 34 Northeast U.S. houses for two heating seasons, and in 8 Northwest U.S. and 14 Whitehorse, Yukon, Canada, houses for one heating season. Stoves included models certified or capable of being certified to Oregon Department of Environmental Quality and U.S. EPA standards. Objectives of the studies were to evaluate the performance of advanced-technology stoves (catalytic, noncatalytic low emission, and catalytic add-on/retrofit devices) relative to conventional technology stoves. Stoves were monitored for particulate emissions, wood use, and creosote accumulation in flue systems. The new-technology stoves models showed the potential to reduce particulate emissions, fuel use, and creosote accumulation. Good performance in at least one installation for most of the stove models indicates that factors such as stove maintenance and fueling practices, as well as technology factors, are important in reducing emissions. Reducing firebox size appears to be a consistent factor in reducing emissions.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 48726, 49557, 49558, 49571, 49766

49550 (DOE/ER/60529—20) Constraints of bioenergetics on the ecology and distribution of vertebrate ectotherms: Progress report, 1 January 1988-31 August 1988. Spotila, J.R. (Drexel Univ., Philadelphia, PA (USA). Dept. of Bioscience and Biotechnology). Jul 1988. Contract FG02-87ER60529. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014314/JAW.

We quantified the constraints of bioenergetics on the ecology and distribution of vertebrate ectotherms. During the first eight months of 1988 we conducted studies to determine the role of incubation temperature on the post hatching growth rate of the snapping turtle, Chelydra serpentina, to establish the rate of energy expenditure of the slider turtle, Trachemys scripta, in the field, to determine the field metabolic rates, body temperatures, and water flux rates of the box turtle, Terrapene carolina, and to measure the effect of diet type on the consumption rate, digestion rate and digestive efficiency of adult T. scripta. We also organized and chaired a national symposium on Constraints of Bioenergetics on Animal Population Dynamics at the 1987 meeting of the American Society of Zoologists. 18 refs.

49551 (INIS-BR—1147-Vol.3, pp 324-330) New volumetric technique for calibrating neutron probes. Encarnacao, F.A.F. da; Carneiro, C.G.; Dall'olio, A. (Universidade Federal Rural de Pernambuco, Recife (Brazil); Pernambuco Univ., Recife (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Studies in laboratory conditions were carried out to determine neutron calibration curves. Soils were packed in barrels to attain values of bulk density similar to those in the field. A mariotte reservoir supplies water to the barrels in a way that keeps a water table of 10 cm. A water flow is established from this saturated region to the top of the barrel. The water depth is correlated to the

numerical integration of the count rate with depth during the process of capillary rise. The coefficient of determination was 0.999. The calibration curve was independent of the initial misture contents of the soil profile.

49552 (INIS-BR—1147-Vol.3, pp 403-412) **Determination of Ra-226 and Th-232 in samples of natural phosphates, industrial gypsums and surface soils by gamma spectrometry.** Pessenda, L.C.R.; Nascimento Filho, V.F. do; Nadai, E.A. de; Barros Ferraz, E.S. de. (Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil); Sao Paulo Univ., Piracicaba (Brazil). Escola Superior de Agricultura Luiz de Queiroz). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The natural radioactivity in Ra-226 and Th-232 in samples of natural phosphates, industrial gypsums (phosphogypsums) and surface soils of different regions was measured by {gamma}-ray spectrometry. The majority of phosphates and gypsums examined showed significantly higher values than soils, mainly in relation to Ra-226 activity. The activity ranges found for phosphates, gypsums and soils were: 79.1 - 3180 Bq/kg, 56.3 - 986.6 Bq/kg, 8.8 - 54.3 Bq/kg for Ra-226 and 33.6 - 1450.3 Bq/kg; 17.4 - 130,1 Bq/kg, 9.8 - 108.9 Bq/kg for Th-232, respectively.

49553 (UCRL—97389) **Applications of a three-dimensional finite element model to mountain-valley flows.** Lee, R.L.; Leone, J.M. Jr. (Lawrence Livermore National Lab., CA (USA)). Feb 1988. Contract W-7405-ENG-48. 8p. (CONF-880936—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88008898/JAW.

From 1. international conference on computational mathematics in flow analysis; Okayama, Japan (5 Sep 1988).

In this paper we will describe briefly a modified finite element procedure which we have developed to solve the non-hydrostatic planetary boundary layer equations. We have exploited several cost effective procedures such as a one-point quadrature scheme and mass lumping in conjunction with an explicit, modified forward Euler, time integration scheme. This simplified approach enables us to achieve computational efficiencies competitive with standard finite difference models. In addition we employ an iterative technique based on a preconditioned conjugate gradient alogrithm for the time-consuming pressure solution portion of the model. In order to realistically model the atmospheric flows of interest we have implemented a "K-Theory" (variable eddy diffusivity) model to parameterize the turbulent fluxes within the boundary layer. The K-model proposed by McNider and Pielke is used for application in nocturnal (stable) situations. In this formulation the vertical eddy diffusion coefficients are calculated as a function of the local Richardson number, a measure of the local stability an air parcel. In daytime (convective) situations, we employ an O'Brien cubic profile to model the vertical variation of the eddy diffusivities. We will present results from simulations in which we employ surface cooling to the approximated surface terrain of Brush Creek to simulate drainage flows down the valley. In particular we will focus attention on comparisons of the model results or the down-valley wind with the observed data. The performance of the proposed variable K turbulence model will be evaluated by comparisons with results from a constant K model and also with observations. 5 refs., 3 figs.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 48077, 48179, 48263, 49176, 49203, 49343, 49493, 49497, 49585, 49601

49554 (AD-A—193106/2/XAB) **Installation-restoration program, Phase 2. Confirmation/quantification Stage 2. Final report, 15 July 1986-7 July 1987.** (Dames and Moore, Park Ridge, IL (USA)). 3 Apr 1988. 353p. NTIS, PC A16/MF A01.

Three sites were investigated at Elelson AFB during the Phase II, Stage 2 field evaluation of the IRP. The sites were the sewage-treatment-plant spill ponds and treated-effluent leaching ponds (Site 32) and two base landfills (Sites 2 and 1). A geophysical survey was performed in the vicinity of the sludge-treatment plant to help define areas of high electromagnetic conductivity (i.e., potential contamination) and aid in the placement of monitor wells. Eight monitor wells were installed during Stage 2. Ground-water samples from Stage 1 and Stage 2 wells were analyzed for purgeable lead, arsenic, cadmium, chromium, mercury, and silver. Soil samples from the vicinity of one of the landfills (Site 1) were tested for the presence of pesticides. Trace quantities of purgeable halocarbons and petroleum hydrocarbons were detected in the wells from all three sites. Drinking-water standards for total trihalomethanes were not exceeded for any of these samples. Arsenic and cadmium were detected in wells at concentrations elevated in the vicinity of the sewage-treatment plant. Only one well, in close proximity to the sewage-sludge drying beds, was found to have nitrate, nitrite concentrations above the Primary Drinking Water Standard. A well downgradient from this site had nitrate, nitrite levels below the same standard. Soils at Site 1 contain trace quantities of DDE, DDD, and DDT. No pesticides were detected in ground water from the monitor well at this site.

49555 (AFME—84-2285) **Study of the underground migration of the heavy metals present in the fertilizing sludge leachates on poplar plantations.** Beaudoing, G.; Charentus, T.; Bertrand, J.; Mouyon, P.; Croze, T.; Soyez, E.; Corompt, P.; Launay, M. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). Nov 1985. 126p. (In French). NTIS (US Sales Only), PC A07/MF A01; GPO Dep. Order Number DE88754626/JAW.

An experimental study concerning the ionic migration of heavy metals such as cadmium, chromium, copper and lead in a soil where waste sludge spreading is regularly realized is presented. It appeared that the heavy metal retention by the soil was highly irreversible and that no trace of metal was detected in ground water. As a conclusion, manuring of 6 to 13 tons per hectare of fertilizing sludge presents no notable risk of heavy metal migration in the soil.

49556 (EPRI-EA—5936) **Bromide transport through an unsaturated field soil: Interim report.** Butters, G.L.; Jury, W.A. (Electric Power Research Inst., Palo Alto, CA (USA); California Univ., Riverside (USA). Dept. of Soil and Environmental Sciences). Jul 1988. 100p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015242/JAW.

A pulse of an inert nonadsorbing bromide tracer was added to the surface of a 0.64 ha loamy sand field to study dispersive transport in the unsaturated zone. The tracer was moved through the soil under bidaily water application from a sprinkler system which produced a quasi-steady state water flow regime. Ninety-one water samples were taken with each sampler during the eighth months of the experiment, which terminated when the pulse completely moved below 4.5 m. One year and 32.5 cm of rainfall later, six soil core samples were taken to 23 m to recover the pulse. The apparent longitudinal macrodispersivity derived from the field average concentration distribution increased linearly between the surface and the 3-m depth, but decreased by 30 percent between 3.0 and 4.5 m. The increase in dispersivity with depth was nearly linear over the first 12 meters of vadose zone except for the decrease between 3 and 4.5 m. This decrease may have been caused by an increase in lateral mixing due to high clay content in this zone.

49557 (INIS-BR—1147-Vol.3, pp 339-347) **Sorption behaviour of herbicides in soils.** Luchini, L.C.; Wiendl, F.M.; Ruegg, E.F. (Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil); Instituto Biologico, Sao Paulo (Brazil). Centro de Radioisotopos). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Environmental contamination by herbicides is related with the sorption phenomenon of these compounds in the soils. The behaviour of paraquat, 2,4-D and diuron was studied in soils with different physico-chemical properties, through the Freundlich adsorption and desorption isotherms, using /sup 14/C-radiolabeled herbicides. Results of the range of the adsorption-desorption of each her-

bicide was related mainly with the chemical characteristics of these compounds.

49558 (INIS-BR—1147-Vol.3, pp 377-386) **Persistence and mobility of the /sup 14/C-DDT organic chlorine insecticide in soil.** Andrea, M.M. de; Ruegg, E.F.; Tomita, R.Y. (Instituto Biologico, Sao Paulo (Brazil). Centro de Radioisotopos). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Data from temperate regions considered DDT as highly persistent. This experiment was set to study what is occurring with DDT residues under the Brazilian tropical environment. Tests with /sup 14/C-DDT are being conducted in soil columns in the field, and in the laboratory at ambient temperature and at 34/sup 0/C. It will cover a two years period. Quantification of /sup 14/C is done by liquid scintillation counting of the organic extracts and /sup 14/CO/sub 2/ from wet-combustion. Results up to 9 months show that disappearance of the compound is enhanced in the field, and even after 6 months very little amounts of the insecticide leached to the deeper sections of the soils columns.

49559 (NP—8770371) **Chemical state of forest soils in Germany between 1920 and 1960, causes and trends of its change.** Ulrich, B.; Meyer, H. (Goettingen Univ. (Germany, F.R.). Inst. fuer Bodenkunde und Waldernaehrung). (Goettingen Univ. (Germany, F.R.). Forschungszentrum Waldoekosysteme - Waldsterben). 1987. 138p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88770371/JAW.

In chapter 1 soil acidification is discussed as a cause of earlier and present forest damage. The approach to get objective knowledge is based on the material balance of forest ecosystems. The causes which affect the material balance (climate, grazing, biomass utilization, clearing, cultivation, acid deposition) are discussed. A scheme is given describing stability, elasticity and resilience of forest ecosystems on the basis of their material balance. The literature is reviewed dealing with earlier forest decline and changes in soil state. Data on the chemical soil state between 1927 and around 1950 are compiled (pH-values and base saturation). At that time strong soil acidification seems, according to these data, being restricted to areas close to strong industrial activities and to the mountain ridges receiving acid cloud droplets. In mixed forests resembling the natural vegetation, the base saturation of the soil was medium to high even on poor parent soil material at that time. Data on changes in soil chemistry since the late 1960ies are compiled. A short review is given about the present chemical state of forest soils, based on representative surveys in northern Germany.

49560 (ORNL/TM—10716) **Results of the fire training facility siting investigation at Davis-Monthan Air Force Base, Tucson, Arizona.** Witt, D.A.; Smuin, D.R.; Williams, J.K. (Oak Ridge National Lab., TN (USA)). May 1988. Contract AC05-84OR21400. 205p. NTIS, PC A10. Order Number DE88015334/JAW.

An investigative drilling and sampling survey at the site of a proposed Fire Training Facility (FTF) at Davis--Monthan Air Force Base, Tuscon, Arizona, was conducted. The objectives of this survey were to provide environmental/chemical information and geotechnical characteristics of the site from soil samples collected at the proposed site, to determine the concentrations of volatile organic compounds (VOCs) and petroleum hydrocarbon contaminants in these samples, and to make an assessment of survey data to determine if the proposed FTF site is environmentally and geotechnically suitable. Results of the chemical analyses indicate the presence of subsurface petroleum hydrocarbons directly related to the former fire training burn pits. Although one of the samples was found to have a relatively high concentration of petroleum hydrocarbons (9300 $\mu g/g$), the contamination was limited in vertical extent, and the location of the bore hole was approximately 61 m (200 ft) downgradient from any construction planned for the proposed FTF site. All chemical analyses performed on bore hole samples for VOCs were found to be at or below detection limits. This indicates that no significant subsurface concentrations of hazardous wastes are present at the site of the planned FTF. The geotechnical investigation performed by The Earth Technology Corporation provided several recommendations for construction of the FTF, but presents no data to indicate that the site planned for the proposed FTF is geotechnically unsuitable. The results of this siting investigation support the location of the new FTF in close proximity to the present fire training area as planned. 10 refs., 6 figs.

49561 (PB—88-208194/XAB) **Soil-gas and geophysical techniques for detection of subsurface organic contamination.** Pitchford, A.M.; Mazzella, A.T.; Scarbrough, K.R. (Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.). May 1988. 81p. (EPA—600/4-88/019). NTIS, PC A05/MF A01.

From 1985 through 1987, the Air Force Engineering and Services Center funded research at the U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory in Las Vegas, Nevada through an interagency agreement. The agreement provided for investigations of subsurface contamination at Air Force Installation Restoration Program sites. The purpose of these investigations was to demonstrate and evaluate inexpensive and relatively rapid reconnaissance techniques which can detect and map subsurface organic contamination. The information can reduce the number and improve the placement of wells required in an investigation. The methods chosen for demonstrations included active and passive soil-gas sampling and analysis, and the geophysical techniques of electromagnetic induction (EM), and direct current resistivity. Field studies were performed at four Air Force Bases. The active soil-gas sampling technique successfully mapped solvents, gasoline, and JP-4 contamination at the four bases where it was used. The passive soil-gas technique was successful in some cases, but not as successful as the active technique. The geophysical methods were also successful for site characterization.

49562 (PB—88-219787/XAB) **Decay of dissolved substances by second-order reaction: problem description and batch-reactor solutions.** Yates, S.R.; Enfield, C.G. (Environmental Protection Agency, Ada, OK (USA). Robert S. Kerr Environmental Research Lab.). 1988. 28p. (EPA—600/J-88/016). NTIS, PC A03/MF A01.

Pub. in Jnl. of Environmental Science and Health, Vol. A23, No. 1, 59-84(1988).

The mass-transport (advection-dispersion) equations allowing coupled second-order reaction (i.e. $omega_1$, C_1) + ($omega_2$, C_2) (R_{12}) -> Re) between two constituents are derived and result in a set of coupled nonlinear partial differential equations. Neglecting the spatial dependence simplifies the equations and produces coupled nonlinear ordinary differential equations for which several analytical solutions are provided. The solutions may be used to illustrate the effect of the second-order reaction mechanism as well as providing a means for evaluating the reaction constant k12.

49563 (PNL-SA—16093) **Acute ecological toxicity and environmental persistence of simulants.** Cataldo, D.A.; Ligotke, M.W.; McVeety, B.D.; Fellows, R.J.; Bolton, H. Jr.; Li, S.W.; Van Voris, P.; Wentsel, R.S. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 10p. (CONF-8803132—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014762/JAW.

From 2. international simulant workshop; Ft. McClellan, AL, USA (2 Mar 1988).

The objectives of these studies are to establish the comparative environmental behavior and chemical fate of chemical simulants. Laboratory studies were undertaken to establish: (1) deposition efficiency (deposition velocities, Vd) for receptor surfaces including plant foliage and soils; (2) dose/response relationships for important environmental components including plants and soil microflora; and (3) the environmental persistence of the simulants. Chemical agent simulants are employed for a range of testing and training activities where use of chemical agents is less than suitable from a safety and environmental standpoint. A variety of chemical simulant materials are used to simulate either nerve agents or blister agents. The following research describes the environmental effects and persistence of four simulants. These are the nerve agent stimulants diisopropyl methylphosphonate (DIMP), diisopropyl fluorophosphate (DFP), and bis (2-ethylhexyl) phosphonate (BIS), and

the mustard stimulant 2-chloroethyl ethyl sulfide (CEES). The vapor pressures for DIMP, DFP, and CEES are relatively high, reported to be 0.17, 0.58 and 3.4 mm Hg, respectively; while that of BIS is substantially less at 5.8 {times} 10/sup {minus}5/ mm Hg at 25{degree}C. The chemical characteristics of DFP and CEES are very similar to G/VX-agents and mustard, respectively, and are employed for materials evaluation under controlled conditions. However, their toxicity precludes their use in the environment. DIMP and BIS are currently used for testing in the open air. 3 figs., 3 tabs.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 48241, 48248, 48593, 48706, 49480, 49541, 49542, 49551, 49552, 49610, 49611, 49612, 49688

49564 **(BMU—1986-138) Investigation of the effectiveness of structural measures for reducing the radiation exposure of the population in aeras with enhanced natural radioactivity. A measuring campaign in existing buildings. Final report.** Leidner, L.; Urban, M. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). 1986. 74p. (In German). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

For this measuring campaign, buildings of different structural design located close to each other have been selected in an area with enhanced natural radioactivity in order to find out any differences in indoor radioactivity levels that can be attributed to structural design features. The measuring results show that the structural condition of the cellar is the decisive factor determining the radon concentration in a house for the case that the surrounding earth is the main radon source. In houses with an unimpaired concrete cellar flooring, radon concentrations in the ground floor have been found to be lower by a factor of 5-10 than in houses with a natural rock basement. Building materials have been found to have an effect at only comparably low radon concentrations. Expected impacts of structural measures, as e.g. thermal insulation windows, could not be proven (except for some half-timber buildings). The results of this measuring campaign that allow a direct house-to-house comparison do not confirm the relation between gamma dose rate and radon concentration postulated by results of a data collection campaign made in various administrative districts. The effectiveness of given structural variations cannot be proven by measurements in existing houses. This would rather require pin-pointed structural modifications for assessment, which can be done in a building chosen for this purpose.

49565 **(CORR—86-0155) Analysis of vegetation stress associated with F-Area and H-Area Seepage Basins using digital remote sensing techniques.** Jensen, J.R.; Mackey, H.E. Jr. (Savannah River Lab., Aiken, SC (USA)). Feb 1986. Contract AC09-76SR00001. 17p. NTIS, PC A03. Order Number DE88014507/JAW.

The F-Area and H-Area Seepage Basins located on the Savannah River Plant (SRP) have been in operation since 1955 for the handling of wastes from the separation facilities. These activities may have had an impact on the vegetation found in this region. This research evaluates digital high resolution aircraft multispectral scanner (MSS) sensor data to identify vegetation stress and map its spatial distribution. 8 refs., 18 figs., 6 tabs.

49566 (INIS-BR—1147-Vol.3, pp 413-421) **Profiles of Cesium-137 and natural radionuclides in a red-yellow latosol from Piracicaba region (SP-Brazil).** Nascimento Filho, V.F. do; Guimaraes, M.deF.; Freire, O.; Barros Ferraz, E.S. de; Pessenda, L.C.R.; Nadai, E.A. de. (Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil); Sao Paulo Univ., Piracicaba (Brazil). Escola Superior de Agricultura Luiz de Queiroz). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The profiles of the radionuclide Cs-137 fallout were measured in a sandy Red-Yellow Latosol at 3 different sampling sites - top, midslope and bottom of a small watershed in the Piracicaba (SP) region. A high resolution gamma spectrometer was used and after 12-15 h counting Cs-137 was not detected at the eroded top, but was found up to 18 and 33 cm depth as midslope and deposition area, respectively. Although Cs-137 activity was much lower than that of North Hemisphere soils, it can be concluded that since 1960 there has been a movement of at least 30 cm of soil from the top and 9 cm from midslope, which accumulated in the sedimentation area. The profiles of the natural radionuclide K-40 and some radioactive daughters of natural series of U-238 and Th-232 will be useful in soil distribution studies in a hydrographic basin only when their occurrence and secular equilibrium in the different soil fractions are known.

49567 (INIS-BR—1147-Vol.3, pp 265-271) **Incorporation and extraction of Cs-134 by the snail 'Biomphalaria glabrata'.** Kikuchi, O.K.; Mastro, N.L. del. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The uptake and loss of Cs-134 produced in IEA-R1 reactor of IPEN was observed in fresh water adult snails. Two activities were employed: 3.700 and 18.500 Bq/l. A monochannel analyzer was used for radioactivity counting and the number of egg-laying and embryo were registered. Maximum up take occured approximately at 8/sup th/ day and the biological half-life was about 6 days. Although the egg-laying and embryo number were diminished with Cs-134 presence, it is not possible to affirm that result due to the small number of animals used.

49568 **(PB—88-212147/XAB) Low-level and narm radioactive wastes. Model documentation: PATHRAE-EPA. Methodology and user's manual. Final report.** Rogers, V.; Hung, C. (Office of Radiation Programs, Washington, DC (USA)). Dec 1987. 150p. (EPA—520/1-87/028). NTIS, PC A07/MF A01.

The PATHRAE-EPA model is used to assess the maximum annual dose to a critical population group (maximum CPG dose) resulting from the disposal of below-regulatory-concern (BRC) wastes. The model is expanded from the PRESTO-EPA-CPG and PRESTO-EPA-BRC models emphasizing two areas: (1) the addition of specific radionuclide exposure pathways pertaining to onsite workers during disposal operation, to offsite personnel after site closure, and to reclaimers and inadvertent intruders after site closure; and (2) the simplification of the sophisticated dynamic submodels to quasi-steady state submodels so that the computation time can be greatly reduced and enable the model to be executed on a personal computer.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 48076, 48383, 48593

49569 **(CONF-880778—1) A microscopic study of iron and manganese oxide distribution in soils from East Tennessee.** Lee, S.Y.; Phillips, D.H.; Ammons, J.T.; Lietzke, D.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013203/JAW.

From International working meeting on soil micromorphology; San Antonio, TX, USA (10 Jul 1988).

Soils and saprolites developed from interbedded shales and limestones of the Conasauga Group are widespread in the Valley and Ridge Province of East Tennessee. Thin sections from four soil profiles were examined by petrographic and scanning electron microscopy including backscatter electron and energy-dispersive x-ray analyses. Iron and manganese released by weathering had migrated differentially downward and precipitated as crystalline and noncrystalline oxides. Differential migration and accumulation of iron

and manganese have been controlled by localized soil microenvironments. Micromorphologic features observed in this study are important in land-use evaluation for hazardous waste disposal. 10 refs., 2 figs.

49570 **(DOE/SR/15191—1) Wildlife management assistance report: Progress report, July 1, 1987--June 30, 1988.** Caudell, M.B. (South Carolina Wildlife and Marine Resources Dept., Columbia (USA)). May 1988. Contract FC09-87SR15191. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014244/JAW.

Activities related to the management of wild life in South Carolina are briefly presented. (CBS)

49571 **(EGG-EES—7951) Research plan for integrated ecosystem and pollutant monitoring at remote wilderness study sites.** Bruns, D.A.; Wiersma, G.B. (EG and G Idaho, Inc., Idaho Falls (USA)). Mar 1988. Contract AC07-76ID01570. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015143/JAW.

This research plan outlines an approach to the measurement of pollutants and ecosystem parameters at remote, high-elevation, wilderness study sites. A multimedia, systems approach to environmental monitoring is emphasized. The primary purpose of the research is to apply and field test a technical report entitled "Guidelines for measuring the physical, chemical, and biological condition of wilderness ecosystems." This document intended to provide Federal Land Managers with information to establish environmental monitoring programs in wilderness areas. To date, this monitoring document has yet to be evaluated under rigorous field conditions at a remote, high-elevation Rocky Mountain site. For the purpose of field testing approaches to monitoring of pollutants and ecosystems in remote, wilderness areas, evaluation criteria were developed. These include useability, cost-effectiveness, data variability, alternative approaches, ecosystems conceptual approach, and quality assurance. Both the Forest Service and INEL environmental monitoring techniques will be evaluated with these criteria. Another objective of this research plan is to obtain an integrated data base on pollutants and ecosystem structure and function at a remote study site. The methods tested in this project will be used to acquire these data from a systems approach. This includes multimedia monitoring of air and water quality, soils, and forest, stream, and lake ecosystems. 71 refs., 1 fig., 9 tabs.

49572 **(UCRL—53851) Natural Phenomena Hazards Modeling Project: Flood hazard models for Department of Energy sites.** Savy, J.B.; Murray, R.C. (Lawrence Livermore National Lab., CA (USA)). May 1988. Contract W-7405-ENG-48. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015344/JAW.

For eight sites, the evaluation of flood hazards was considered in two steps. First, a screening assessment was performed to determine whether flood hazards may impact DOE operations. The screening analysis consisted of a preliminary flood hazard assessment that provides an initial estimate of the site design basis. The second step involves a review of the vulnerability of on-site facilities by the site manager; based on the results of the preliminary flood hazard assessment and a review of site operations, the manager can decide whether flood hazards should be considered a part of the design basis. The scope of the preliminary flood hazard analysis was restricted to evaluating the flood hazards that may exist in proximity to a site. The analysis does not involve an assessment of the potential of encroachment of flooding at specific on-site locations. Furthermore, the screening analysis does not consider localized flooding at a site due to precipitation (i.e., local run-off, storm sewer capacity, roof drainage). These issues were reserved for consideration by the DOE site manager. 9 refs., 18 figs.

5106 Regulations

REFER ALSO TO CITATION(S) 48701, 48762, 49547, 49620

49573 **(PB—88-217575/XAB) Background document for First Third wastes to support 40 CFR (Code of Federal Regulations) Part 268 land-disposal restrictions. Proposed rule. First third waste volumes, characteristics, and required and available treatment capacity. Part 1.** (Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste). Mar 1988. 147p. (EPA—530/SW-88/030A). NTIS, PC A07/MF A01.

See also PB—88-213368.

This background document discusses the quantities of First Third wastes affected by today's proposed rule and assesses the required and available alternative treatment and recycling capacity for these wastes.

49574 **(PB—88-220397/XAB) Superfund Record of Decision (EPA Region 9): Operating Industries, Monterey Park, California (first remedial action), July 1987. Final report.** (Environmental Protection Agency, Washington, DC (USA)). 31 Jul 1987. 40p. (EPA/ROD/R—09-87/013). NTIS, PC A03/MF A01.

The Operating Industries, Inc. site, a landfill located in Monterey Park, California received municipal and industrial liquid and sludge wastes. EPA took over operations of gas-processing activities and has been conducting site control and monitoring activities at the site since May 1986. Additionally, EPA has conducted a number of emergency actions to mitigate potential threats to public health and the environment. Leachate generated at the site is a hazardous waste and contains volatile organic compounds including trichloroethene, vinyl chloride, benzene, and toluene. The selected remedial action for the site includes site control and monitoring activities.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 48122, 48726, 49550, 49749, 49771

49575 **(DOE/ER/60492—4) Root surface acid phosphatases and their role in phosphorus assimilation by Eriophorum vaginatum.** Kroehler, C.J.; Linkins, A.E. (Clarkson Univ., Potsdam, NY (USA). Dept. of Biology). [1988]. Contract FG02-86ER60492. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014136/JAW.

Eriophorum vaginatum is a dominant plant in much of the arctic tundra ecosystem where phosphorus is frequently a limiting nutrient. The mineralization of this organic phosphorus was thought to be principally controlled by microbial respiration, however, more recent work shows that extracellular soil phosphatases are the principal regulators. The existence of plant root and mycorrhizal surface phosphatases which are capable of hydrolyzing organic phosphorus compounds, suggests that soil organic phosphorus may be directly utilized by plants. Since E. vaginatum is a tussock forming sedge with a very dense annually produced rooting system which can exploit most of the tussock soil volume, its surface phosphatases may play a dominant role in organic phosphorus hydrolysis into inorganic phosphorus. Of equal significance would be the potential for this activity to contribute to the phosphorus nutrition through the coupling of phosphorus hydrolysis on the root and root uptake of the resultant inorganic phosphorus. Phosphatase activity was investigated and found to be uniformly distributed along the surface of the root. Kinetic analysis of the enzyme gave estimates of 9.23 mM for the apparent Km and $1.61 * 10^{-3}$ μmoles mm-2 hr^{-1} for the apparent Vmax. Saturation values for E. vaginatum phosphatases are about 3 times higher than average soil solution organic phosphorus concentrations. 12 refs., 4 figs.

49576 (PB—88-195409/XAB) Southwest Florida Shelf regional biological communities survey, Year 3. Final report. (Continental Shelf Associates, Inc., Jupiter, FL (USA)). Feb 1987. 1053p. NTIS, PC E99.

Set includes PB—88-195417 through PB—88-195433. See also PB—86-246147.

A separate abstract is included for each of the three sections of this report.

49577 (PB—88-195417/XAB) Southwest Florida Shelf regional biological communities survey, Year 3 final report. Volume 1. Executive summary. Technical report. Phillips, N.W. (Continental Shelf Associates, Inc., Jupiter, FL (USA)). Feb 1987. 51p. NTIS, PC A04/MF A01.

See also Volume 2, PB—88-195425 and PB—86-246147; Also available in set of 3 reports PC E99, PB—88-195409.

In 1980, the Minerals Management Service initiated a multiyear program to study the marine ecosystem of the Gulf of Mexico as part of its outer continental shelf environmental studies program. This particular program, the Southwest Florida Shelf Program, has three primary goals: (1) benthic habitat mapping with geophysical instruments, 35-mm camera, and video camera; (2) benthic, faunal, and sediment characterization (sampling with trawl, dredge, and grab); and (3) hydrographic characterization. The Year 3 report, prepared in three volumes, describes the third year of environmental studies. Volume I is the Executive Summary. Volume I provides an introduction of the study and describes the hydrography, benthic habitat mapping, live-bottom, and soft-bottom stations. The Year 3 study was designed to fill gaps in habitat maps produced during Years 1 and 2, and to sample stations in shallower water depths (10-20 m) than those previously sampled.

49578 (PB—88-195425/XAB) Southwest Florida Shelf regional biological communities survey, Year 3. Final report. Volume 2. Technical report. Phillips, N.W. (Continental Shelf Associates, Inc., Jupiter, FL (USA)). Feb 1987. 421p. NTIS, PC A18/MF A01.

See also Volume 1, PB—88-195417, Volume 3, PB—88-195433 and PB—86-246147; Also Available in set of 3 reports PC E99, PB—88-195409.

In 1980, the Minerals Management Service initiated a multiyear program to study the marine ecosystem of the Gulf of Mexico as part of its outer continental shelf environmental studies program. The particular program, the Southwest Florida Shelf Program, has three primary goals: (1) benthic habitat mapping with geophysical instruments, 35-mm camera, and video camera; (2) benthic, faunal, and sediment characterization (sampling with trawl, dredge, and grab); and (3) hydrographic characterization. The Year 3 report, prepared in three volumes, describes the third year of environmental studies. Volume II presents the scope and general methods, which are followed by separate chapters devoted to hydrography, habitat mapping, live-bottom stations, soft-bottom stations, sediment hydrocarbons, and potential impacts of offshore oil-related activities.

49579 (PB—88-195433/XAB) Southwest Florida Shelf regional biological communities survey, Year 3. Final report. Volume 3. Appendices. Technical report. Phillips, N.W. (Continental Shelf Associates, Inc., Jupiter, FL (USA)). Feb 1987. 581p. NTIS, PC A25/MF A01.

See also Volume 2, PB—88-195425; Also available in set of 3 reports PC E99, PB—88-195409.

In 1980, the Minerals Management Service initiated a multiyear program to study the marine ecosystem of the Gulf of Mexico as part of its outer continental shelf environmental studies program. This particular program, the Southwest Florida Shelf Program, has three primary goals: (1) benthic habitat mapping with geophysical instruments, 35-mm camera, and video camera; (2) benthic, faunal, and sediment characterization (sampling with trawl, dredge, and grab); and (3) hydrographic characterization. The Year 3 report, prepared in three volumes, describes the third year of environmental studies. Volume III contains appendices providing methodological details and data listings.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 48049, 48050, 48051, 48052, 48053, 48137, 48171, 48290, 48294, 48596, 48702, 49157, 49158, 49176, 49497, 49518, 49520, 49528, 49554, 49560, 49561, 49562, 49613, 49648, 49733, 49749

49580 (AD-A—193188/0/XAB) Environmental-impact research program: coupling hydrodynamics to a multiple-box water-quality model. Final report. Bird, S.L.; Hall, R. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab.). Mar 1988. 56p. (WES/TR/EL—88-7). NTIS, PC A04/MF A01.

Long-term, multidimensional water-quality modeling, using directly linked hydrodynamic and water-quality models, can become prohibitively expensive. In this report, fine-scale, short time-step hydrodynamic model output is linked with coarse-grid, longer time-step multiple-box water-quality model. The formulation, limitations, and adaption for use in applications of the Water Quality Analysis Simulation Program (WASP), the US Environmental Protection Agency multiple-box model, are discussed. Linkage of the multiple-box model to two hydrodynamic models is explained. Dye tracer simulations are used to compare mass transport by the box model with mass transport by the directly linked models for three applications: Savannah River Estuary, Mississippi Sound, and DeGray Lake.

49581 (AD-A—193398/5/XAB) Research and development for health and environmental hazard problem definition study: fate and effects of five pesticides of military importance on secondary biological waste-water treatment plants. Final report, April-December 1980. Nelken, L.H.; Broome, M.G.; Lyman, W.J.; Scow, K.M.; Steber, W.D. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Jan 1981. 319p. (ADL-C—83744-06). NTIS, PC A14/MF A01.

This report reviews the literature pertaining to the fate and effects of five pesticides (Baygon, Chlordane, Diazinon, Dursban, and Malathion) introduced in dilute concentrations to secondary wastewater treatment plants. The review addresses the following subjects: the rates and products of biodegradation of the pesticides in both pure and mixed (from sources such as sewage, soils, ponds, etc.) microbial cultures; toxic or inhibitory levels of the pesticide which are disruptive to the ecology or operation of biological waste-water treatment plants; and chemical processes, such as hydrolysis, volatilization, and adsorption which reduce the concentrations of the pesticide in the effluent. Literature citations were obtained by a computerized search of twenty data bases, communication with pesticide manufacturers, government agencies, and university researchers. A manual search of Chemical Abstracts was conducted for Baygon and Chlordane. The report contains a detailed description of the experimental conditions and results of each article pertaining to the biodegradation and effects of each pesticide.

49582 (AL—8503) Sampling and analysis in the Arctic marine benthic environment. Vol. 2. Guide to practice. (Arctic Labs. Ltd., Inuvick, Northwest Territories (Canada)). Mar 1985. vp. (CE—01784). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

There is an increasing requirement for environmental information on Arctic marine sediments because of natural resource development, particularly offshore hydrocarbon exploration and associated proposed transport mechanisms. At the same time, it is recognized that methods that have been used for collection, analysis and data reporting need improvement if the data are to have long term value. This is the second part of a study to produce a guide for managers and planners involved in the collection and analysis of environmental data from marine sediments in Arctic regions. The first phase of this study (Volume 1) reviewed existing methods and was intended to serve as a background document to the present report. The format is designed to outline in a step-by-step manner the factors to be considered and offers suggestions as to possible methods to achieve various results. This guide includes sampling strategy and means of quality control, sampling and subsampling

methods for chemical analysis, sampling methods for benthos, means of sample preservation and storage, sampling logistics (transport, positioning and sampling from ice), methods of sample analysis for metals, organics, grain size, Pb-210 dating, methods of laboratory quality assurance and methods for the analysis of benthic data. 319 refs., 14 figs., 44 tabs.

49583 **(AL—8503) Sampling and analysis in the Arctic marine benthic environment. Vol. 1. Review of methods.** (Arctic Labs. Ltd., Inuvick, Northwest Territories (Canada)). Mar 1985. vp. (CE—01785). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report is the first part of a guide for managers and planners involved in the collection and analysis of environmental data from marine sediments in Arctic regions. This report provides an overview of available methods and serves as a background document to Volume 2, a guide to plannng and selection of suitable procedures. The report is organized into three sections: an introduction outlining the background and rationale for the project, a review of sampling methods, and a review of analytical techniques. Because of the large volume of information available, especially for analytical techniques, the review is not exhaustive. Rather, the review has focussed on methods in current use as well as relatively new methods which appear to offer significant improvements. 31 figs., 74 tabs.

49584 **(DOE/FC/10120—2550-Vol.1) The effects of fly ash and flue-gas desulfurization wastes on groundwater quality in a reclaimed lignite strip mine disposal site: Volume I: Final report.** Beaver, F.W.; Groenewold, G.H.; Manz, O.E.; Hassett, D.J. (North Dakota Univ., Grand Forks (USA). North Dakota Mining and Mineral Resources Research Inst.). Aug 1987. Contract AK18-80FC10120;AT21-80FC10230;AT18-83FC10612. 273p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE88001048/JAW.

Coal conversion wastes were generated at a lignite-fired, steam-electric power station near Center, North Dakota, and were buried in unsaturated and saturated settings within the nearby strip mine, typical of settings used by the industry. The field study of the effects of fly ash and flue gas desulfurization (FGD) wasts on groundwater quality in a reclaimed lignite strip mine disposal site ran for eight years beginning in 1978. Chemical analyses for major cations and anions, As, Se, Mo, Ba, Pb, Cr, Hg, and other constituents were performed on groundwater samples from selected settings and strata. Fly ash and the FGD waste initially generate highly mineralized leachates from entrained water. Fly ash generates an initially high ph leachate. FGD wastes produce normal (6-9) pH values. Leachate pH is quickly buffered to the six to nine range within the sediments. Arsenic and selenium are simultaneously attenuated to acceptable levels. Lead, cadmium, and barium are maintained at low levels by sulfate and carbonate precipitation reactions. Molybdenum remains mobile in this hydrogeochemical setting. The cation exchange capacity of Na-montmorillonite clays may account for decreases in calcium and increases in sodium concentration levels with depth. Sulfate concentration levels decline with depth where bacterially-induced sulfate reduction apparentlay occurs. Pozzolanic activity within the fly ash deposits, in both saturated and unsaturated settings, apparently reduces the mobility of all constituents. A disposal site, well above the reestablished groundwater table, protected from recharge, is considered the best setting for disposal of these wastes because very little leachates forms. Lined disposal sites are therefore unnecessary to control regulated trace elements, but would be necessary to contain sodium, calcium, sulfate, and molybdenum migration in saturated settings. 30 refs., 256 figs., 6 tabs.

49585 **(DOE/ID—22075) Concentrations of nine trace metals in ground water at the Idaho National Engineering Laboratory, Idaho.** Mann, L.J.; Knobel, L.L. (Geological Survey, Idaho Falls, ID (USA)). May 1988. Contract AC07-76ID01570. 17p. (MISC—88094; USGS-OFR—88-332). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015177/JAW.

Reconnaissance-level sampling for nine trace metals in ground water was conducted at the Idaho National Engineering Laboatory during June to November 1987. Water samples from 81 wells that tap the Snake River Plain aquifer and that are equipped with dedicated pumps were collected and analyzed for arsenic, barium, beryllium, cadmium, chromium, lead, mercury, selenium and silver; one sample from a discontinuous perched-water zone was collected with a thief sampler and analyzed for beryllium. Methods used to collect the water sample and quality assurance instituted for the sampling program are described in detail. Except for beryllium and chromium, the concentration of the trace metals in water from the 82 wells were less than their respective maximum contaminant level for drinking water established by the US Environmental Protection Agency. The maximum concentration of beryllium was 0.7 μg/L (micrograms per liter) which is near the reporting level; no maximum contamination level has been established for beryllium. The chromium concentrations in water from wells that tap the Snake River Plain aquifer ranged from less that 1 to 280 μg/L. Water from 2 of the 81 wells contained 50 μg/L or more, which is the maximum contamination level for chromium; in water from the 30 production wells, the largest chromium concentration was 20 μg/L. 13 refs., 3 figs., 2 tabs.

49586 **(EPRI-CS—5910-Vol.2) Round-robin study of methods for trace metal analysis: Volume 2, Atomic absorption spectroscopy: Part 2: Final report.** Maddalone, R.F.; Scott, J.W.; Frank, J. (Electric Power Research Inst., Palo Alto, CA (USA); TRW, Inc., Redondo Beach, CA (USA). Applied Technology Div.). Aug 1988. 518p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015355/JAW.

The objective of this phase (Analytical Methods Qualification) of the project is to develop validated precision and bias statements for selected elements in utility matrices. Four elements (cadmium, iron, mercury, and zinc) were validated in six matrices (river water, ash pond overflow, seawater intake, seawater discharge, treated chemical metal cleaning wastes, and reagent grade water). Cadmium was validated for GFAAS; iron and zinc by Flame AAS; and mercury by CVAAS. Each test matrix was spiked and split into 4 concentrations: a background and 3 samples of increasing concentration. Each participant received four 500 mL sample bottles for each matrix they analyzed. Approximately 40 utility laboratories participated in the study. A statistical analysis program based on ASTM D2777-85 was developed and used to produce statements of precision and bias for each element and method. The raw and outlier free data distributions were tested for normality. The precision data were used to compute limits of detection (LOD) and quantitation (LOQ) for all the elements by matrix. The results from this study tend to indicate the inappropriateness of using single operator, single laboratory data to represent routine monitoring capability in utility matrices. 22 refs., 55 figs., 35 tabs.

49587 **(ORNL/TM—10723) Dynamics of aquatic ecosystems and models under toxicant stress: State space analysis, covariance structure, and ecological risk.** Johnson, A.R.; Bartell, S.M. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 207p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88015333/JAW.

The state of an ecosystem at any time t may be characterized by a multidimensional state vector x(t). Changes in state are represented by the trajectory traced out by x(t) over time. The effects of toxicant stress are summarized by the displacement of a perturbed state vector, x/sub p/(t), relative to an appropriate control, x/sub c/(t). Within a multivariate statistical framework, the response of an ecosystem to perturbation is conveniently quantified by the distance separating x/sub p/(t) from x/sub c/(t) as measured by a Mahalanobis metric. Use of the Mahalanobis metric requires that the covariance matrix associated with the control state vector be estimated. State space displacement analysis was applied to data on the response of aquatic microcosms and outdoor ponds to alkylphenols. Dose-response relationships were derived using calculated state space separations as integrated measures of the ecological effects of toxicant exposure. Inspection of the data also revealed that the covariance structure varied both with time and with toxicant exposure, suggesting that analysis of such changes might be a useful tool for probing control mechanisms underlying ecosystem dynamics. 90 refs., 53 figs., 9 tabs.

49588 **(PB—88-199922/XAB) Sensitivity-constrained nonlinear programming: a general approach for planning and design under parameter uncertainty and an application to treatment plant design. Final report.** Uber, J.G.; Kao, J.J.; Brill, E.D.; Pfeffer, J.T. (Illinois Univ., Urbana (USA). Dept. of Civil Engineering). 1988. 231p. NTIS, PC A11/MF A01.

One important problem with using mathematical models is that parameter values, and thus the model results, are often uncertain. A general approach, Sensitivity Constrained Nonlinear Programming (SCNLP), was developed for extending nonlinear optimization models to include functions that depend on the system sensitivity to changes in parameter values. Such sensitivity-based functions include first-order measures of variance, reliability, and robustness. Thus SCNLP can be used to generate solutions or designs that are good with respect to modeled objectives, and that also reflect concerns about uncertainty in parameter values. A solution procedure and an implementation based on an existing nonlinear-programming code are presented. SCNLP was applied to a complex activated sludge waste-water treatment plant design problem.

49589 **(PB—88-200548/XAB) Municipal waste treatment by supracell flotation, chemical oxidation and STAR (sludge thickening and alum recovery) system. Technical research report 1985-86.** Krofta, M.; Wang, L.K. (Lenox Inst. for Research, Inc., MA (USA)). 22 Oct 1986. 25p. (LIR—10-86/214). NTIS, PC A03/MF A01.

This report documents effectiveness of a Krofta Supracell Type 4 Clarifier installed at the Bangor, Maine, Pollution Abatement Facility for the treatment of primary effluent. It includes detailed theory, principles, and test results on the permanganate oxidation-reduction system and the sludge thickening and alum recovery system. Reductions of total suspended solids, chemical oxygen demand, and 5-day biological oxygen demand are presented.

49590 **(PB—88-200555/XAB) Winter operation of nation's first potable flotation plant. Technical report.** Krofta, M.; Wang, L.K. (Lenox Inst. for Research, Inc., MA (USA)). 20 Sep 1987. 22p. (LIR—06-87/255). NTIS, PC A03/MF A01.

See also PB—88-200563.

The town of Lenox, Massachusetts, has an innovative 1.2-MGD (million gallon per day) potable water treatment plant, known as Sandfloat, on their reservoir system. The Sandfloat package plant is 22 ft in diameter and 6 ft in depth. It incorporates chemical flocculation, dissolved air flotation, and sand filtration into one unit, and has only 15 minutes of total detention time. Lenox Plant has performed extremely well since July 1982. The Lenox reservoir system consists of two separate but adjacent impoundments (Upper Root Reservoir & Lower Root Reservoir) which are separated by a dam and open channel and about 15 ft elevational difference. Normally the water quality of these two reservoirs is very similar. However, the characteristics of Upper Root Reservoir water worsens in winter. The paper describes the seasonal turnover problems and the town's effort in solving the winter operational problems with an innovative chemical known as poly aluminum chloride (Ultrion).

49591 **(PB—88-200563/XAB) Winter operation of nation's largest potable flotation plant. Technical report.** Krofta, M.; Wang, L.K. (Lenox Inst. for Research, Inc., MA (USA)). 20 Sep 1987. 29p. (LIR—06-87/256). NTIS, PC A03/MF A01.

See also PB—88-180336.

The heart of the Pittsfield (Massachusetts) water-supply system is two potable flotation plants: Ashley Plant (2 Sandfloats) and Cleveland Plant (4 Sandfloats). Each sandfloat unit has a capacity of 6.25 MGD (million gallons per day). Sandfloat is a package clarifier consisting of flocculation, flotation, and filtration. Complete chronological testing of Pittsfield's two plants in the winter period, December 1986 through March 1987, is documented. The technical and economical feasibilities of Sandfloat are presented. Cleveland raw water having sufficient alkalinity and low temperature in winter was treated satisfactorily by Sandfloat at 6.25 MGD per unit using the chemical combination of sodium aluminate, polymer, and alum at a cost of $0.02458/1000 gal. At Ashley Plant, the mixture of 28% Ashley raw water and 72% Farnham raw water, having moderate alkalinity and low winter temperature was treated adequately by Sandfloat at 5.5-5.8 MGD per unit using the same chemicals. When 100% Farnham raw water with extremely low alkalinity and low pH was treated at Ashley Plant, PAC, sodium aluminate and polymer 1849A was found to be the best chemical combination for clarification.

49592 **(PB—88-200613/XAB) Removal of arsenic and other contaminants from storm run-off water by flotation, filtration, adsorption and ion exchange. Technical report, September-November 1984.** Krofta, M.; Wang, L.K. (Lenox Inst. for Research, Inc., MA (USA)). 1 Nov 1984. 56p. (LIR—11-84/1). NTIS, PC A04/MF A01.

Color illustrations reproduced in black and white.

The feasibility of removing soluble arsenic (+5) from storm runoff water by dissolved air flotation (Supracell), dissolved air flotation and sand filtration combination (Sandfloat), granular carbon adsorption, and ion exchange processes was experimentally demonstrated. The best pretreatment unit was Sandfloat clarifier consisting of both flotation and filtration. Sandfloat clarifier consistently removed over 90% of arsenic, turbidity, and color, and over 50% of chemical oxygen demand and oil and grease. Using a Sandfloat or a Supracell for pretreatment, and then using either carbon adsorption or ion exchange for second-stage treatment, the soluble arsenic in the storm water can be totally removed.

49593 **(PB—88-200621/XAB) Analysis of sludges generated from flotation treatment of storm run-off waters. Technical report 1982-1984.** Krofta, M.; Wang, L.K.; Wu, B.C.; Janas, J. (Lenox Inst. for Research, Inc., MA (USA)). 14 Nov 1984. 22p. (LIR—11-84/14). NTIS, PC A03/MF A01.

The most-feasible process for removal of suspended solids, arsenic, color turbidity, and oil and grease from storm water treatment is either dissolved air flotation (Krofta Supracell) or dissolved air flotation-filtration (Krofta Sandfloat), depending on the effluent discharge standards. The report documents the pretreatment data and the characteristics of floated sludge by dissolved air flotation. The dewatered sludge met the current New Jersey Dept. of Environmental Protection limits on cadmium, chromium, copper, nickel, lead, and zinc for land application.

49594 **(PB—88-209218/XAB) Wast-ewater reclamation and reuse.** Hattingh, W.H.J.; Van Vuuren, L.R.J. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research). 31 Oct 1986. 14p. NTIS, PC E04/MF E04.

Abstract in Afrikaans; North American Continent sales only.

After 15 years, the introduction of water reclamation to this country and the experience gained over a period of almost two decades in producing a potable water and water for industrial application, this concept has not gained the recognition that it deserves. Why is this so. This paper attempts to answer this question, by overviewing the present state-of-the-art and attempts to identify areas for further research.

49595 **(PB—88-211677/XAB) Evaluation of sorption isotherms for selected azo dyes as predictors of fate in an activated-sludge wastewater-treatment process.** Lieberman, R.J.; Shaul, G.M.; Dempsey, C.R.; Dostal, K.A. (Cincinnati Univ., OH (USA). Dept. of Civil and Environmental Engineering). May 1988. 6p. NTIS, PC A02/MF A01.

Azo dyes are of concern because of their widespread production and use and their potential adverse environmental and health impacts. Environmental exposure is normally via aqueous effluents of manufacturing and use industries, and treatment is at municipal waste-water treatment plants by the activated-sludge process. The report evaluates an inexpensive and timely protocol for predicting the fate of the dyes.

49596 **(PB—88-211693/XAB) Alternative drinking-water treatment technology applications from Superfund sites: development of a national register.** Goodrich, J.A.; Clark, R.M.; Von Huben, H.; Bianchin, S. (Environmental Protection Agency, Cincinnati, OH (USA). Water Engineering Research Lab.). May 1988. 14p. (EPA—600/D-88/087). NTIS, PC A03/MF A01.

This paper describes a prototype program initiated by U.S. EPA's Drinking Water Research Division (Cincinnati, Ohio), Region V Drinking Water Program (Chicago, Illinois), and Technology Evaluation Section (Edison, New Jersey) to inventory the types of drinking water related technology being applied at Superfund sites. Data from local utilities and State-funded sites were also included, accounting for nearly half the data collected at this time. Ground water as well as surface-water sites were inventoried. Future monitoring and research could focus on organic contaminants subject to variable influent and on other toxic wastes.

49597 **(PB—88-213046/XAB) Destruction of cyanide in waste waters: review and evaluation. Final report.** Weathington, B.C. (Hittman Ebasco Associates, Inc., Columbia, MD (USA)). May 1988. 72p. NTIS, PC A04/MF A01.

This report presents a review of known cyanide destruction technologies with respect to applicability, feasibility, effectiveness, and cost. Particular emphasis was placed on the destruction of complex cyanides. Laboratory studies were conducted to evaluate a photocatalytic process to convert simple cyanides, iron cyanides and thiocyanates to cyanate using (TiO_2) and ultraviolet radiation. The scope of the problem of cyanide in waste water or leachate and the effectiveness of twelve different technologies that have been applied to the destruction of cyanide were assessed by review of available literature and discussions with industry and government authorities. Brief summaries of the problem and the current technologies are contained in the report. In general, the primary concern with cyanide effluent is its propensity to form complexes difficult to remove and that can later break down to highly toxic forms.

49598 **(PB—88-215009/XAB) National Surface Water Survey: analysis of data from long-term monitoring of lakes.** Newell, A.D.; Powers, C.F.; Christie, S.J. (Northrop Services, Inc., Corvallis, OR (USA)). Jun 1987. 168p. NTIS, PC A08/MF A01.

See also PB—88-133749.

The Long-Term Monitoring Project was originally designed to monitor trends in low acid neutralizing capacity (ANC) surface waters across a gradient of acidic atmospheric deposition. Only lake data are presented in the report. A total of 121 lakes in four regions of the U.S. were sampled. Historical data were available for some subregions, resulting in a 7-year record of seasonal samples. Due to this short period of record and to the inconsistent sampling schedules of the historical data, trend analysis was not performed on the Long-Term Monitoring Project data; however, the data were useful for examination of design aspects for a monitoring program.

49599 **(PB—88-218367/XAB) Comparison of geostatistical methods for estimating virus inactivation rates in ground water.** Yates, M.V.; Yates, S.R. (Environmental Protection Agency, Ada, OK (USA). Robert S. Kerr Environmental Research Lab.). 1987. 9p. (EPA—600/J-87/353). NTIS, PC A02/MF A01.

Pub. in Water Research, Vol. 21, No. 9, 1119-1125(1987).

Enteric viruses are responsible for a large number of ground-waterborne disease outbreaks every year. Septic tanks are the most frequently cited causes of ground-water contamination in disease outbreaks. Controlling the placement of septic tanks such that all viruses would be non-infective by the time the effluent reached drinking water wells would likely reduce the number of waterborne viral-disease outbreaks. The study compares different geostatistical techniques (kriging, cokriging, and combined kriging and regression) that estimate virus inactivation rates in ground water. These estimates were used with the regional ground-water flow characteristics to estimate septic tank setback distances over a city-wide area. Combined kriging and regression, which eliminates the need for laboratory values of virus inactivation rates by using the linear regression relationship between temperature and inactivation rates, produced comparable results to the other two methods, yet reduced the cost of the analysis considerably.

49600 **(PB—88-218441/XAB) Trouble-shooting an existing treatment plant.** Logsdon, G.S.; Mason, L.; Stanley, J.B. (Environmental Protection Agency, Cincinnati, OH (USA). Drinking Water Research Div.). Jun 1988. 21p. (EPA—600/D-88/126). NTIS, PC A03/MF A01.

This paper reviews the procedures used during the investigation of the Carrollton Water Filtration Plant in February, 1987, at the time of a waterborne outbreak caused by Cryptosporidium. Recommendations for improvements in equipment and operating procedures are given, and the changes made are described. Information is presented on present water-quality vs. quality before the outbreak. Improvements to the 8-MGD plant have cost about $300,000.

49601 **(PB—88-219472/XAB) Testing of toxicology and emissions-sampling methodology for ocean incineration of hazardous wastes. Final report, January 1985-January 1986.** Boehm, P.; Cooke, M.; Carr, S.; Piispanen, W.; Werme, C. (Battelle Ocean Sciences, Duxbury, MA (USA)). May 1988. 366p. NTIS, PC A16/MF A01.

This report addresses the development and testing of a system to expose marine organisms to hazardous-waste emissions in order to assess the potential toxicity of incinerator plumes at sea as they contact the marine environment through air-sea exchange and initial mixing. A sampling train was designed and tested at EPA's land-based hazardous-waste incinerator, using transformer oil as a waste feed. The incinerator was operated under conditions which would be appropriate for at-sea incinerators. The sampling train (Marine Incineration Biological Assessment Sampler--MIBAS) provides a sea-water sample containing a plume emission for the marine organisms testing. Five toxicity-test protocols were refined and/or developed for use in the program: (1) a sea-urchin fertilization test; (2) a chronic test using macroalgae Champia parvula; (3) a 7-day chronic test using growth and reproduction of the crustacean Mysidopsis bahia; (4) a 7-day growth and survival test with the fish Menidia beryllina; and (5) a 7-day life-cycle test using the archiannelid worm Dinophilus gyrocilatus. The results of applying these tests during a hazardous-waste burn are given.

49602 **(PB—88-219639/XAB) Environmental degradations by microorganisms at low temperatures. Waste water treatment.** Halmo, G. (SINTEF, Trondheim (Norway)). 30 Dec 1987. 36p. (STF—21-A87112). NTIS, PC E04/MF E04.

The paper describes the attempts of using specially selected bacterial sludges for low-temperature removal of organic and nitrogen components in waste water. Each step, carbon oxidation, nitrification, and denitrification was studied in detail and various configurations for a complete process were tested.

49603 **(PB—88-866025/XAB) Waste treatment by reverse osmosis and membrane processes: industrial. January 1976-June 1988 (citations from the Engineering Index data base). Report for January 1976-June 1988.** (National Technical Information Service, Springfield, VA (USA)). Jun 1988. 128p. NTIS PC N01/MF N01.

Supersedes PB—87-863551.

This bibliography contains citations concerning the use of membranes to treat industrial waste water. Reverse osmosis, ion exchange, electrodialysis, and ultrafiltration processes are described. Removal of metals, sodium compounds, nitrates, flourides, dyes, and radioactive waste using membranes is examined. Wastewater treatment for chemical, pulp, textile, and steel mills using this technology is included. (This updated bibliography contains 246 citations, 26 of which are new entries to the previous edition.)

49604 **(PB—88-866272/XAB) Water pollution: uptake of heavy metals by shellfish and marine plants. January 1974-June 1988 (Citations from Oceanic Abstracts). Report for January 1974-June 1988.** (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 113p. NTIS PC N01/MF N01.

Supersedes PB—86-858719.

This bibliography contains citations concerning heavy metal contamination of shellfish and marine plants. Toxicity levels and the long term effects on the ecology of the marine environment are discussed. The growth rate of marine life as a function of metal concentration and the long term effects on the food chain are also considered. (This updated bibliography contains 281 citations, 12 of which are new entries to the previous edition.)

49605 **(UCRL—21008-Vol.9) Evaluation of military field-water quality: Volume 9, Data for assessing health risks in potential theaters of operation for US military forces: [Final report].** Daniels, J.I.; Layton, D.W. (eds.). (Lawrence Livermore National Lab., CA (USA)). Feb 1988. Contract W-7405-ENG-48. 201p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88013814/JAW.

Data are presented in this volume for assessing the health risks in populations of military personnel that could result as a consequence of exposure to field waters containing constituents or infectious organisms of military concern, which are from natural and anthropogenic sources, at levels above those recommended as field-water-quality standards (i.e., above safe levels). Turbidity and color are the physical properties that are of military concern in field water. The other constituents that are of military concern in field water are (1) total dissolved solids, (2) chloride, (3) magnesium, (4) sulfate, (5) arsenic, (6) cyanide, (7) the pesticide lindane, and (8) metabolites of algae and associated bacteria. Bacteria, viruses, and parasites (e.g., protozoa and helminths) are categories of water-related infectious organisms that are of military concern. Figures were developed from dose-response data to enable military risk managers to quickly assess the potential performance-degrading effects in personnel exposed to a measured concentration of a particular constituent in field water. The general physical, chemical, and biological quality of field waters in geographic regions worldwide, representing potential theaters of operation for U.S. military forces, also are evaluated. This analysis is based on available water-quality monitoring data and indicators of likely water-quality conditions (e.g., geohydrology, climate, sanitation, industrialization, etc.). Accompanying our evaluation are maps and tables alerting military planners and risk managers to the physical, chemical, or biological quality of field water that can be expected generally in geographic regions of concern.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 48248, 48308, 49480, 49541, 49542

49606 **(IG—88/01) Tritium content of precipitation and surface water in Austria in 1987.** Rank, D.; Rajner, V.; Lust, G. (Bundesversuchs- und Forschungsanstalt Arsenal, Vienna (Austria)). 1988. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703999/JAW.

This report includes weighted monthly /sup 3/H-means from 22 precipitation sampling stations, /sup 3/H-concentrations of daily precipitation samples from the station Wien-Arsenal, and /sup 3/H-concentrations of monthly samples from 17 surface water sampling stations. 18 figs., 3 tabs.

49607 (INIS-BR—1147-Vol.3, pp 425-436) **Marine environmental monitoring related to sea disposal of radioactive waste in the NE Atlantic Ocean.** Bettencourt, A.O.; Elias, M.D.T.; Ferrador, G.C. (LNETI, Dep. de Proteccao e Seguranca Radiologica, Sacavem (Portugal)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Reference is made to the sea disposal of packaged radioactive waste in the NE Atlantic and to the role of the OCDE Nuclear Energy Agency (NEA) since 1967, in the dumping operations. The objectives of marine environmental monitoring in relation to sea disposal of radioactive wastes are described as well as the coordinated research and environmental surveillance programme (CRESP) developed within NEA frame. The Portuguese on-going programme in this field is presented and the results concerning measurements of /sup 239+240/Pu, /sup 238/Pu, /sup 241/Am and /sup 137/Cs in samples of water, sediments and fish collected at Madeira and Continental Portuguese coasts, are discussed. It was observed that these radionuclides concentrations are lower for deep-sea fishes than for the shallow-water ones. The obtained results are compared with those found in the literature. From the observation of the large spectrum of results available, it can be concluded that no generalized contamination of the marine environment due to the sea dumping of radioactive wastes if observed at present. On the other hand, there is an interest in pursuing analyses of deep-sea fish with the aim of early detection of any possible modifications in the actual levels of radioactivity in the marine environment.

49608 (INIS-BR—1147-Vol.3, pp 281-293) **Transit and absorption of nuclear industry derivatives by marine biota.** Mayr, L.; Moraes, R.; Lopes, M.A.; Vicente, C.; Mauro, J.N. (Rio de Janeiro Univ. (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A broard research program on radionuclides became necessary due to the construction of the Nuclear Power Plant at Angra dos Reis. As part of this program the research developped by the Marine Biology Departament, UFRJ, aimed at estimating the radiation doses to wich the population of the region might be exposed and to determine biological indicators to radioactive contamination. Up to the present moment, the bioacumulation factors (BFs) of /sup 60/Co, /sup 137/Cs and /sup 131/I by "clam" (Anomalocardia brasiliana) and the biological half-life of cobalt and cesium in this animal were determined, as well as the B.F. of /sup 85/Sr by "snail" (Strombus pugilis) and by "barnacle" (Megabalanus tintinnabulum). The remobilization of /sup 60/Co by microbiological activity in marine sediment was also studied. These studies were made using the standard methodology for bioaccumulation and elimination in closed water systems. The results showed an important microbiological activity in the remobilization of elements in the sediment. Due to the low bioaccumulation factors obtained the studied organisms were not considered ideal biological indicators for radioactive pollution. However, their importance as edible animals in the Angra dos Reis region recommends their radiometry for routine radiological monitoring. Studies on other organisms and/or radionuclides are now in progress at the Marine Biology Departament (UFRJ).

49609 **(INIS-BR—1215) Flow injection spectrophotometric determination of low concentrations of orthosphate in natural waters employing ion exchange resin.** Pessenda, L.C.R. (Sao Paulo Univ., Piracicaba (Brazil). Escola Superior de Agricultura Luiz de Queiroz). 1981. 82p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704007/JAW.

A simple and fast method for the determination of low concentrations of orthophosphate in natural waters is described. Ion exchange is incorporated into a flow injection system by usina a resin column in the sample loop of a proportion injector. Effects of sample aspiration rate, sampling time, eluting agent concentration, pumping rate of the sample carrier stream and interfaces, were investigated both using /sup 32/PO/sup 3-//sub 4/ or /sup 31/PO/sup 3-//sub 4/ with columns coupled to a gerger-muller detector and incorporated in a flow system with molybdenum blue colorinetry. (M.A.C.).

49610 **(PB—88-212139/XAB) Low-level and narm radioactive wastes. Model documentation: PRESTO-EPA-BRC. Methodology and user's manual. Final report.** Rogers, V.; Hung, C. (Office of Radiation Programs, Washington, DC (USA)). Dec 1987. 254p. (EPA—520/1-87/027). NTIS, PC A12/MF A01.

See also PB—88-212105.

The PRESTO-EPA-BRC model was used to assess the cumulative population health effects (including fatal cancer deaths and serious genetic effects) to the general population residing in the downstream regional water basin as a result of the disposal of LLW in an unregulated sanitary landfill. The model is considered a member of the PRESTO-EPA family of models. The model is

modified from the PRESTO-EPA-POP model primarily on the addition of the radionuclide transport pathways in the biosphere including: (1) workers' and visitors' dust exposures; (2) population exposures from incinerator releases; (3) workers' and visitors' gamma exposure; and, (4) onsite farming.

49611 **(PB—88-213152/XAB) Low-level and narm radioactive wastes model documentation PRESTO-EPA-DEEP: methodology and users manual. Final report.** Rogers, V.; Hung, C. (Office of Radiation Programs, Washington, DC (USA)). Dec 1987. 266p. (EPA—520/1-87/025). NTIS, PC A12/MF A01.

The PRESTO-EPA-DEEP model was used to assess the cumulative population health effects (including fatal cancer deaths and serious genetic effects) to the general population residing in the downstream regional water basin as a result of the disposal of LLW using deep geological disposal methods. The model is considered a member of the PRESTO-EPA family of models. The model is modified from the PRESTO-EPA-POP model primarily in the area of radionuclide transport in the geosphere. Interested persons may apply the model, using appropriate and applicable input data, for assessing the cumulative population health effects resulting from the disposal of LLW using a deep geological disposal method.

49612 **(PNL—6634) Environmental monitoring at Hanford for 1987: Surface and Columbia River data.** Jaquish, R.E. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 288p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE88014942/JAW.

Environmental monitoring at the Hanford Site, located in southeastern Washington State is conducted for the US Department of Energy. The data collected provide a historical record of radionuclide and radiation levels attributable to natural causes, worldwide fallout, and Hanford operations. Data are also collected to monitor the status of chemicals on the site and in the Columbia River. This volume contains the actual raw data used to create the summaries in PNL--6464.

49613 **(WHC-EP—0105) Internal letters on ground-water monitoring of the separations area, Hanford Site.** Serkowski, J.A. (Westinghouse Hanford Co., Richland, WA (USA)). Dec 1987. Contract AC06-87RL10930. 609p. NTIS, PC A99. Order Number DE88013649/JAW.

This is a compilation of reports on ground-water monitoring of the separations area, Hanford Site. Reports are grouped under the following headings: quarterly reports—4th quarter 1982 to 2nd quarter 1983; monthly reports—September 1983 to June 1985; monthly reports--briefing book—September 1985 to September 1987. (ATT)

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 49594

5206 Regulations

REFER ALSO TO CITATION(S) 48701, 48762, 49547, 49574, 49596

49614 **(CONF-8704318—) Consequences of the new water protection law for business.** (Institut fuer Gewerbliche Wasserwirtschaft und Luftreinhaltung e.V. (IWL), Koeln (Germany, F.R.)). 1987. 131p. (In German). NTIS (US Sales Only), PC A07. Order Number DE88770357/JAW.

From IWL forum on consequences of the new water protection law for business; Koeln, F.R. Germany (8 Apr 1987).

The forum of the 'Institut fuer gewerbliche Wasserwirtschaft und Luftreinhaltung (IWL)' held in April 1987 studied the challenges presented to business by the water protection policy as laid down in the amendments to legislation in the year before. New demands are, for instance, made on direct or indirect polluters, hazardous materials, or the operators of plant in connection with the handling of potentially water-polluting materials. Papers deal with: Essential amendments of the water protection law of 1986 for industry and trade; Conclusions to be drawn and problems presented for companies discharging waste water indirectly; What must in future be done and observed in companies when handling water-polluting materials; Need for, and position and endowment of the water protection officer in companies - responsibility and liability. (HSCH).

49615 **(PB—88-213533/XAB) Comments on EPA's (Environmental Protection Agency's) effluent-limitation guidelines covering the lead-acid battery manufacturing industry.** (JACA Corp., Fort Washington, PA (USA)). Jan 1984. 38p. NTIS, PC A03/MF A01.

Lead-acid batteries, one of eight types, account for about 70% of annualized control costs facing the battery manufacturing industry as a result of EPA's guidelines. This report is the industry's response. It makes counter recommendations for effluent limitations, discusses selected control technologies and effluent limitations, makes control cost estimates, and provides an economic impact analysis and a benefits effectiveness analysis.

49616 **(PB—88-213939/XAB) Ground-water quality standards in other states: a survey report.** (Illinois Dept. of Energy and Natural Resources, Springfield (USA)). Jan 1988. 50p. (IL/ENR/RE/PA—88/01). NTIS, PC A03/MF A01.

In the fall of 1986, anticipating passage of a comprehensive ground-water protection law for the state, the Illinois Department of Energy and Natural Resources conducted a survey of ground-water quality standards in other states. Of the 49 states mailed the survey, 39 responded and 17 reported having ground-water standards. The survey was divided into sections: existing standards, proposed standards, ground-water pollutant evaluation, groundwater standard setting, application of ground-water standards, enforcement, and opinion as to the effectiveness of the state program. The report, based on the responses of the 17 states reporting ground-water standards, follows the survey format. Each section begins with a summary of survey results and concludes with individual responses from each state.

49617 **(PB—88-215116/XAB) Economic impact study of proposed site-specific changes to water-pollution regulations affecting the city of Tuscola, Douglas County, Illinois. Final report.** John, S.F.; Skelton, L.W.; Kane, D.N.; Hinesly, T.D. (Institute of Technology Assessment, Springfield, IL (USA)). Apr 1988. 81p. NTIS, PC A05/MF A01.

The City of Tuscola petitioned the Illinois Pollution Control Board for a site-specific rule change for its North Sewage Plant and South Sewage Plant, to obtain relief from certain provisions of the Ill. Admin. Code, Title 35, Subtitle C, Water Pollution Rules and Regulations of the Pollution Control Board. Included in the petition were requests for relief from the following regulations: Section 304.120 Deoxygenating Waste and Suspended Solids; Section 303.205 Phosphorus; Section 306.103 Treatment Plant Bypasses; and Section 303.212 Ammonia Nitrogen and Unionized Ammonia. The City maintained that compliance would require the construction of 5.1 millio dollar plant (1983 estimate) and result in no environmental benefit. As an alternative the City proposed to construct a 2.5 million dollar facility and request site specific exemption to the existing standards. In addition to the two alternatives proposed by Tuscola, the report examines two other wastewater management strategies. These strategies included a slow rate land treatment system and the construction of conventional facilities with a level of treatment falling between the two conventional options proposed by Tuscola. Impacts related to a wide variety of wastewater constituents were evaluated in qualitative terms.

49618 **(PB—88-215124/XAB) Economic-impact study of petition for regulatory relief from phosphorus effluent limits, City of Pana r84-44. Final report.** Blaser, W.L.; McQuown, J.R.; Rickert, W.R.; Huggins, D.B. (Blaser, Zeni and Co., Springfield, IL (USA)). Apr 1988. 123p. NTIS, PC A06/MF A01.

The City of Pana, which operates a municipal waste-water treatment plant, asserted that the expenditures made to reduce phosphorus levels in its effluent exceeded any resulting environmental benefits. Therefore, it petitioned the Illinois Pollution Con-

trol Board requesting a site-specific rule change that would relieve it from effluent phosphorus regulations, or alternatively, to raise its allowable limit from 1.0 milligrams per liter to 2.8 milligrams per liter. The report examines the direct costs and benefits of Pana's request.

49619 **(PB—88-215132/XAB) Economic impact of proposed site-specific changes to water-pollution regulation affecting Joliet, Illinois. Final report.** Pershall, R.B. (Booker Associates, Inc., St. Louis, MO (USA)). May 1988. 111p. NTIS, PC A06/MF A01.

This report provides an analysis of the economic and environmental impacts of a petition filed by the City of Joliet requesting site-specific relief from Illinois state water-quality regulations for biological oxygen demands (BOD) and suspended solids. Joliet proposes that its Eastside Wastewater Treatment plant be allowed to meet effluent limitations established for the Des Plains River rather than the effluent limitations for Hickory Creek. The study examines two general strategies for complying with the existing standards. One possibility is to upgrade the current treatment system. The other option analyzes relocating the outfall to the Des Plaines River.

49620 **(PB—88-220405/XAB) Superfund Record of Decision (EPA Region 9): North Hollywood/Burbank Well Field Area 1, San Fernando Valley Site, California (first remedial action), September 1987. Final report.** (Environmental Protection Agency, Washington, DC (USA)). 24 Sep 1987. 77p. (EPA/ROD/R—09-87/014). NTIS, PC A05/MF A01.

The North Hollywood - Burbank Well Field (NHBWF) is located within the San Fernando Valley Ground Water basin, which can provide drinking water for approximately 500,000 people residing in the San Fernando Valley and Los Angeles. In 1980 TCE and PCE were discovered in 25% of DWP's wells. In July 1981, DWP and the Southern California Association of Governments began a two-year study funded by EPA. The study revealed the occurrence of ground-water contamination plume patterns that are spreading toward the southeast. The primary contaminant of concern to the ground-water is TCE with PCE and other VOCs present. The selected remedial action for the site is ground-water pump and treatment using aeration and granular-activated-carbon - air-filtering units, with discharge to the DWP Pumping Station for chlorination and distribution. Spent carbon will be removed and replaced with fresh carbon, with the spent carbon scheduled either for disposal or regeneration. The estimated capital cost for this remedial action is $2,192,895 with present worth O&M of $2,284,105.

49621 **(PB—88-220413/XAB) Superfund Record of Decision (EPA Region 9): Litchfield Airport/Phoenix, Arizona (first remedial action), September 1987. Final report.** (Environmental Protection Agency, Washington, DC (USA)). 29 Sep 1987. 65p. (EPA/ROD/R—09-87/012). NTIS, PC A04/MF A01.

The Litchfield/Phoenix-Goodyear Airport (PGA) site is divided into a northern and a southern area by a ground-water divide running under the Yuma Road area. Section 16 (approximately 17 acres) lies in the southern area and includes the Loral Corporation facility (formerly owned by Goodyear Aerospace Corporation) and the Phoenix-Goodyear Airport (formerly owned by U.S. Navy), both being potential sources of VOC contamination. Ground-water contaminant concentrations in Section 16 are at least 100 times greater than down-gradient levels. The Arizona Department of Health Services discovered solvent and chromium contamination in the ground water within the PGA area. Additional sampling in 1982 and 1983 found 18 wells contaminated with TCE. The primary contaminants of concern include: trichloroethene, volatile organic compounds and chromium. Interim remedial action for the site is proposed.

49622 **(PB—88-221098/XAB) NPDES (National Pollutant Discharge Elimination System) Compliance Inspection Manual (May 1988).** (SRA Technologies, Inc., Alexandria, VA (USA)). May 1988. 229p. NTIS, PC A11/MF A01.

Supersedes PB—85-115897.

The National Pollutant Discharge Elimination System (NPDES) Compliance Inspection Manual has been developed to support inspection personnel in conducting field investigations fundamental to the NPDES compliance program and to provide inspectors with standardized procedures for conducting complete, accurate inspections. The information presented in the manual will guide a qualified inspector in conducting an accurate inspection. The manual presents standard procedures for inspection; it is assumed the inspector has a working knowledge of waste water and related problems, regulations, and control technologies. The manual will serve the experienced inspector as a flexible and easy reference. New inspection personnel will find support in the orderly and detailed presentation of the material. The manual presents the most current information on NPDES compliance inspections available at the time of publication.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 48149, 48749

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 48121, 48701, 48722, 48821

49623 (CONF-8403264—Exc., pp 1.10.1-1.10.14) **Operation of buildings: Energy supply and energy conservation measures.** Kraft, H. 1985. (In German). NTIS (US Sales Only), PC A12. Order Number DE88770313/JAW.

From Technical meeting on energy supply and regional structure; Munich, F.R. Germany (14 Mar 1984).

ISW-Manuskriptreihe.

Energy saving in public administration. A list-like collection of the measures to monitor the consumption, the measures of saving energy at existing buildings, new systems and by new techniques. Examples with figures for the savings achieved in the region of Marburg-Biedenkopf (Hesse). Guidelines are set up which are mainly based on energy saving, heat recovery, use of new technologies and renewable energy sources, fluidized-bed combustion also in smaller plants of ca. 2 MW, waste management separating wastes into burnable/unburnable, information of the public administration and the people and the setting up of energy concepts. (PJH).

49624 **(ORNL/TM—10776) Review of studies related to uncertainty in risk analsis.** Rish, W.R.; Marnicio, R.J. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 144p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88015335/JAW.

The Environmental Protection Agency's Office of Radiation Programs (ORP) is responsible for regulating on a national level the risks associated with technological sources of ionizing radiation in the environment. A critical activity of the ORP is analyzing and evaluating risk. The ORP believes that the analysis of uncertainty should be an integral part of any risk assessment; therefore, the ORP has initiated a project to develop framework for the treatment of uncertainty in risk analysis. Summaries of recent studies done in five areas of study are presented.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 48392, 49563, 49575, 49629, 49684, 49710

49625 **(AD-A—193495/9/XAB) Anti-cyanide drugs. Annual summary report, 1 April 1986-31 March 1987.** Hambright, P. (Howard Univ., Washington, DC (USA). Dept. of Chemistry). 1 May 1987. 33p. NTIS, PC A03/MF A01.

The cyanide uptake abilities of over forty low-molecular-weight aldehydes, ketones, metal ions, and metal complexes were

measured at pH 7.4, with millimolar solutions. The compound 2,6-pyridine dicarboxaldehyde bound two moles of CN, glyoxylic acid bound-one mole, and all other aldehydes, ketones, and keto acids reacted and substantially less cyanide than expected, based on the groups present. Cobalt(II) rapidly binds five moles, nickel(II) four moles (as did several palladium(II) complexes), and gold(III) bromide reacts with three moles of CN. Cobalt(III) porphyrins are four times more effective than hydroxocobalamin in cyanide scavenging ability on a per-gram basis.

49626 (LA—11309-MS) Development and characterization of an HPLC [high-performance liquid chromatography] system for the fractionation of bronchoalveolar lavage fluid. Gurley, L.R.; Valdez, J.G.; London, J.E.; Spall, W.D.; Dethloff, L.A.; Lehnert, B.E. (Los Alamos National Lab., NM (USA)). Aug 1988. Contract W-7405-ENG-36. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014682/JAW.

A high-performance liquid chromatography (HPLC) method has been developed for fractionating the protein components of the lung's extracellular lining fluid, as sampled by bronchoalveolar lavage. With this method, 10 ml of rat bronchoalveolar lavage fluid (BALF) in phosphate buffered saline can be quantitatively analyzed rapidly and reproducibly. This volume (25% of the lavage fluid volume from one rat using a standardized lavage technique) is made 0.2% with respect to trifluoroacetic acid (TFA) and pumped through a μBondapak C_{18} Radial-PAK HPLC column equilibrated with H_2O/0.2% TFA. Six fractions are then eluted with a series of acetonitrile gradients and isocratic steps that progress from H_2O/0.2% TFA to 65% CH_3CN/0.2% TFA. Following these steps in the procedure, five additional fractions are eluted with methanol. All eleven fractions are detected by monitoring the column effluents at 206 nm and can be recovered by lyophilization since all the components of the HPLC solvent system are volatile. Nine of the eleven fractions were found to contain protein. Three of the fractions contained proteins common to the blood compartment. Of the largest fraction contained albumin and the next largest contained the immunoglobulins. Six other protein fractions appeared to be derived from the cells of the lung inasmuch as they were not detected in plasma. 60 refs., 7 figs., 1 tab.

49627 (LA-UR—88-1812) Relationship of the superoxide dismutase genes, sodA and sodB, to the iron uptake ({ital fur}) regulon in {ital Escherichia coli} K-12. Niederhoffer, E.C.; Naranjo, C.M.; Fee, J.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-8804139—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014461/JAW.

From UCLA symposia; Frisco, CO, USA (10 Apr 1988).

Expression of sodA, as indicated by MnSod activity is normal in {ital fur} mutants. This suggests that sodA is not a member of the {ital fur} regulon and that the putative Fe-binding, regulatory protein of sodA, suggested by Moody and Hassan is not the Fur protein. by contrast, expression of sodB, as indicated by FeSod activity, is completely blocked in {ital fur} mutants and the effect is restored by transformation with a plasmid having a normal {ital fur} locus. The observations suggest that Fur, either directly or indirectly, controls SodB biosynthesis. Additional observations are described which indicate that SodB and Fur act together in a complicated fashion to control the biosynthesis of enterobactin. 26 refs., 3 tabs.

5503 Cytology

49628 (UCID—21381) University of California Program for Analytical Cytology five-year report, 1982-1987. Stull, S. (ed.); Calkins, M. (Lawrence Livermore National Lab., CA (USA); California Univ., San Francisco (USA). Dept. of Lab. Medicine). 1987. Contract W-7405-ENG-48. 97p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88014311/JAW.

The Program for Analytical Cytology (PAC) was created by the Regents of the University of California on June 17, 1982. The purposes of the Program are to encourage research into theoretical, scientific, and engineering aspects of analytical cytology and into its biological and clinical applications.

5504 Genetics

REFER ALSO TO CITATION(S) 49627

49629 (DOE/ER/60408—T2) Correlation of chromosome patterns in human leukemic cells with exposure to chemicals and/or radiation: Progress report, September 1, 1987-June 15, 1988. Rowley, J.D. (Franklin McLean Memorial Research Inst., Chicago, IL (USA)). Jun 1988. Contract FG02-86ER60408. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014535/JAW.

Progress made in understanding the molecular genetics of leukemia is described. Several genes which correlate with leukemogenesis were mapped to chromosome 5, viz., IL-3 gene which codes for a hematopoietic colony-stimulating factor is deleted with myeloid del (5q), IL-4 gene which codes for B cell stimulatory factor-1, IL-5 gene which codes for eosinophil-differentiation factor, CD-14 which codes for a myeloid specific transmembrane protein, and EGR1 which codes for a zinc-finger protein. 10 refs., 3 figs. (DT)

5505 Metabolism

REFER ALSO TO CITATION(S) 48343, 49567, 49608, 49637, 49685, 49687

49630 (ISH—97) Carbon metabolism in humans. Holtum, J.A.M.; Latzko, E.; Wirth, E. (Muenster Univ. (Germany, F.R.). Botanisches Inst. und Botanischer Garten). (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). Sep 1986. 106p. Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene.

The authors attempt to sketch the biochemical, spatial and temporal partitioning of naturally ingested carbon in the human body. Some of the dietary and developmental factors which affect such partitioning are also mentioned. The partitioning of carbon isotopes within the body, and their turnover times, will be discussed.

49631 (KFK—4428) Copper resorption in isolated rat hepatocytes. Heck, D.; Ochs, A.; Buscher, H.P.; Thom, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Freiburg Univ. (Germany, F.R.). Medizinische Klinik 2; Freiburg Univ. (Germany, F.R.). Inst. fuer Organische Chemie und Biochemie). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). May 1988. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754674/JAW.

Our aim is to investigate the Cu-uptake by isolated rat hepatocytes in an in-vitro experiment. Hepatocytes are cultured on foils to form cellular monolayers, which are exposed to CuSO/sub 4/ solution. The trace elements P, S, Cl, K, Ca, Fe, Cu, Zn and Br are determined by PIXE, sweeping the proton microbeam in two dimensions across selected regions of the cell cultures. The concentration averages over positions covering the interior of hepatocytes or the intercellular gaps are formed and the behaviour of the various trace elements is studied as a function of the copper solution exposure time. In most cases cell nuclei are identified and evaluated separately.

5506 Medicine

REFER ALSO TO CITATION(S) 49224, 49233, 49405, 49605, 49628, 49687, 49688, 49710, 49723

49632 (AD-A—193370/4/XAB) Decontamination systems for the skin. Annual report, 1 July 1986-31 July 1987. Lyle, R.E.; McMahon, W.A.; Trujillo, D.A. (Southwest Research Inst., San Antonio, TX (USA)). 31 Aug 1987. 47p. (SWRI—01-8728). NTIS, PC A03/MF A01.

The second year's efforts of this program was to procure or prepare clays, modified clays and polymers and evaluate these

solids as decontamination materials against CW agents. The simulants for CW agents used are representative of blister agents (chloroethyl ethyl sulfide (CEES) and G agents (nerve agents) diethylchlorophosphate (DECP).

49633 **(AD-A—194133/5/XAB) Decontamination systems for skin. Annual report, 1 August 1985-30 June 1986.** Lyle, R.E.; McMahon, W.A.; Trujillo, D.A. (Southwest Research Inst., San Antonio, TX (USA)). 1 Jul 1986. 52p. NTIS, PC A04/MF A01.

The first year's effort of the program was to procure or prepare clays, modified clays and polymers and evaluate these solids as decontamination materials against CW agents. The simulants for CW agents used are representative of blister agents (chloroethyl ethyl sulfide (CEES) and G-agents (nerve agents) diethylchlorophosphate (DECP)). The four-minute test was qualified as a test method for evaluating the decomposition rate and capacity of these various materials. In addition, the four minute test time period can be extended to 8, 16, 60 and 120 minutes to determine whether the reactive properties of these materials is catalytic or stoichiometric. On the basis of the above test, the authors have identified a number of excellent candidates as decontamination materials. These are RT-004, modified Fuller's earth (water washed) (MFE/H2O), poly(vinylbenzyl diethylenetriamine) DS-2 (PVB DETA (DS-2)), a copper complex of the polymer (PVB DETA (Cu)) and the quaternary salt of poly(vinylbenzyl chloride) with 4-diamethyl aminopyridine and bicarbonate (PVB DMAP (HCO3-)). The latter three polymeric materials are very effective against DECP whereas the first two clays are reactive with CEES and, to a lesser extent, with DECP. The polymeric materials appear to cause catalytic decomposition of DECP. Their efforts to prepare a polymeric material which is effective against both CEES and DECP is in progress.

49634 **(FRNC-TH—3260) Processing of acquisition data for a time of flight positron tomograph.** Robert, G. (Ecole Nationale Superieure d'Electricite et de Radio-Electricite, 38 - Grenoble (France)). Oct 1987. 97p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754740/JAW.

After a review of basic principles concerning the time of flight positron tomography, the LETI positron tomograph is briefly described. For performance optimization (acquisition, calibration, image reconstruction), various specialized operators have been designed: the realization of the acquisition system is presented.

49635 (INIS-BR—1147-Vol.3, pp 245-254) **Nifedipine effect on the labelling of blood cells and plasma proteins with Tc-99m.** Gutfilen, B.; Boasquevisque, E.M.; Bernardo Filho, M. (Universidade do Estado do Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The labeling of red blood cells (RBC) with Tc-99m depends on the presence of stannous ion (Sn) that helps this radionuclide's fixation on the hemoglobin molecule. Nifedipine is an agent capable to block a specific way where calcium (Ca) ion crosses the cellular membrane and to bind itself on plasma proteins. The effect of nifedipine in the labeling of RBC and plasma proteins with Tc-99m was studied because of similarities between Ca and Sn ions. Blood with anticoagulant was treated with nifedipine concentration of 10/sup -6/M for 15 min at 37/sup 0/C. The labeling of RBC with Tc-99m was done incubating with Sn ion solution (3 uM) for different times. The % of radioactivity in RBC was determined. Samples of plasma were precipited with trichloroacetic acid and the % of radiocctivity in insoluble fraction was calculated. The same procedure was done using different nifedipine concentrations and the blood was incubated for 60 min with Sn ion. The determination of the % of Tc-99m labeled in RBC and plasma proteins showed that this drug does not have the capability to alter this incorporation because the results are similar to control. It is suggested that the Sn ions passage across RBC is not altered by nifedipine although this drug could bind to plasma protein, it does not modify the Tc-99m fixation on it.

49636 (INIS-BR—1147-Vol.3, pp 189-198) **"In vivo" and "in vitro" studies on 2,6-diisopropylphenylcarboylmethyliminodiacetic acid labelled with/sup 99m/Tc (disida-/sup 99m/Tc).** Martinez, D.Y.F.; Barbosa, M.F. de; Muramoto, E.; Achando, S.S.; Silva, C.P.G. da. (Direccion General de Energia Nuclear, Guatemala City (Guatemala); Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The "in vivo" and "in vitro" studies on DISIDA-/sup 99m/Tc at the hepatobiliary level were made. The binding of DISIDA-/sup 99m/Tc to plasma proteins and the fraction at which this binding occurs were determined. The distribution coefficient in n-octanol/saline solution was 0.41 showing the lipophilicity of the compound. The images in rats show the biological distribution as well as the hepatobiliary clearance of the radiopharmaceutical under its unmetabolized form.

49637 (INIS-BR—1147-Vol.3, pp 199-208) **Radiochemical and biological control for metaiodobenzylguanidine (MIBG) labelled with /sup 131/I.** Barbosa, M.R.F.F. de; Muramoto, E.; Colturato, M.T.; Goncalves, R.S.V.; Pereira, N.P.S. de; Almeida, M.A.T.M. de; Silva, C.P.G. da. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

This study shows the standardization of the radiochemical control of MIBG-/sup 131/I in eletrophoretic system and also the biological control in Wistar rat for a period of time, not longer than 60 minutes after the tracer administration.

49638 (INIS-BR—1147-Vol.3, pp 169-179) **Small-scale extraction and radioiodination of human hormones for the substitution of imported radioimmunoassay reagents.** Gimbo, E.K.; Ribela, M.T.C.P.; Borghi, V.C.; Schwarz, I.; Morganti, L.; Araujo, E.A.; Bartolini, P. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The methods for national production of radioimmunoassay reagents to substitute imported kits of: highly purified unlabelled hormones for radioiodination; /sup 125/I-labelled hormones; and specific high titre antisera are presented. The extraction and purification of human growth hormone (hGH) and human luteinizing hormone (hGH) were done from human pituitaries. The /sup 125/I-labelled hormones are obtained by stoichiometric methods. The / sup 125/I-hGH, /sup 125/I-hLH, I-hTSH and /sup 125/I- h calcitonin were prepared and tested in internal and external quality control, in comparison with imported products. The parameters such as: maximum binding to specific antiserum (Bo), nonspecific binding (NSB), mean effective dose (ED 50), sensitivity and accuracy were evaluated. (M.C.K.).

49639 (INIS-BR—1147-Vol.3, pp 209-218) **Development of a solid phase technique for radioimmunoassay for triiodothyronine (T/sub 3/) in serum.** Hamada, M.M.; Mesquita, C.H. de; Silva, C.P.G. da. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

We have developed a solid phase radioimmunoassay (RIA) system for triiodothyronine (T/sub 3/), by immobilizing triidothyronine antibodies on the inner wall of reaction tubes. The antibody-coated tubes were made via reaction of antibody with glutaraldeyde residue pre coated on the inner wall of the tubes by alkaline self-polimerization. The quality of the coated tubes was tested

through its performance in the RIA methodology, by analysing the following RIA parameters: minimum detectable dose (DMD), non-specific binding (NSB), "X/sub 50/%", slope of the standard curve, intra and inter-assay precision, accuracy of the method and figure of merit. The serum levels of T/sub 3/ in hypothyroid and hyperthyroid patients and the normal values range were determined for the solid phase RIA system. The results are in agreement with found in the literature.

49640 **(INIS-BR—1225) Preoperative irradiation in breast cancer.** Monti, C.R. (Universidade Estadual de Campinas (Brazil)). 1987. 4p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704017/JAW.

Forty-eight patients with breast cancer stage III - (VICC 1978) were submitted to preoperative radiation with tumor dose of 5.000 cGy in five weeks. The period of treatment and observation was from March 1977 to December 1986. (M.A.C.).

49641 **(INIS-mf—11282) Early determination of the congenital hypothyroidism by means of the cuantification of STH and T4 by radioimmunoassay method.** De Penados, R.C. (Unidad de Medicina Nuclear de la Direccion General de Energia Nuclear (Guatemala)). (Universidad de San Carlos de Guatemala, Guatemala City). Nov 1986. 138p. (In Spanish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88704027/JAW.

It was investigated the advantages and disadvantages and conditions of working for the diagnosis of the congenital hypothyroidism by RIA, and its future implementation. It was determined concentration of neonatal STH and neonatal T4 in whole blood of 517 new borns, obtained by capilar punction and recollected in filter paper. 261 samples were found with levels of T4 between normal limits and STH between 0 and 12.5 u U/ml correspond to a normal thyroid function. 29 samples with normal T4 and STH above 30 u U/ml, correspond to a possible primary hypothyroidism. 171 samples with normal T4 and STH between 12.5 and 30 u U/ml were found.

49642 **(INIS-mf—11794) Thyroid malignancies at the Esslingen Radiation Institute.** Oppermann, D. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1982. 84p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754654/JAW.

This work concerns itself with the results of the therapy of thyroid malignancies in the years 1968-1979. The frequency of differentiated/undifferentiated tumors was 90.9/9.1%, follicular/papillary carcinomas 71.4/19.5%. Three times as many women suffer from thyroid cancer as men. Differentiated carcinomas appear preferably in middle age (50 a), undifferentiated around 60 to 70 years. Papillary carcinomas metastasise in 26.7% of the cases in the neck region and 6.7% in the lungs, follicular in 34.5%, the most frequent, in the lungs. The therapy method used was I 131 and/or telecobalt. The 3-year survival rate with undifferentiated tumors was 27%, the 5-year survival rate of papillary carcinoma was 40%, of follicular carcinoma 33%. Clearly papillary carcinomas have the best prognosis of all thyroid malignancies, especially when they appear in younger patients. (orig./TRV).

49643 **(LA-UR—88-869) Comparison of surface modifications of poly(ether urethanes) by chemical infusion and graft polymerization.** Wrobleski, D.A.; Cash, D.L.; Hermes, R.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-880912—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88007887/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

Our approach to surface modification uses the chemical infusion process to introduce materials into the outermost layer of the polymeric material, thereby altering the surface without changing the bulk properties of the polymer. The infused materials may slowly diffuse out of the infusion layer if they are volatile or highly mobile. However, if polymeric infusant materials are employed, they may become chain entangled with the host polymer and result in a permanently modified surface. A second approach utilizes photo-initiated graft polymerization of poly(ether urethanes) with an appropriate monomer. We have explored both of these methods by examining the infusion of polyvinylpyrrolidone (PVP) and poly(ethylene glycol) (PEG) into commercially available poly(ether urethanes) and the graft polymerization of N-vinyl pyrrolidone onto poly(ether urethanes). Results are presented here. 7 refs., 1 tab.

49644 **(NEI-NO—50) Radiographic diagnoses and treatment decisions on approximal caries.** Espelid, I. (Bergen Univ. (Norway)). 1987. 92p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754747/JAW.

Mineral loss which represents a threshold value for radiographic diagnosis, cannot be defined exactly. For clinical use 10% mineral loss in the direction of the X-ray beam may constitute a border line lesion for radiographic detection, and caries lesions without cavitation seemed to be beyond this diagnostic threshold. The degree of caries estimated by using radiographs is fairly closely related to the depth of the tissue changes recorded in the prepared cavity. Radiographic examinations more often lead to underestimation than overestimation of the degree of caries. Radiographic caries diagnoses made at different degrees of penetration toward the pulp showed insignificant variations with respect to quality, but the observers were more confident of caries being present (used more strict criterion) when they scored caries in inner dentin. Consensus on diagnostic criteria and improved diagnostic quality are considerably more important to the quality of therapeutic decisions on appoximal caries than viewing conditions and film density. A semi-radiopaque material in Class II fillings seems to offer advantages compared to amalgam in respect of the diagnosis of secondary caries and marginal defects. There is a danger that dentists will restore approximal caries lesions too early and before these can be diagnosed in dentin radiographically. Reprints of seven previously published papers; 87 refs.

49645 **(ORNL/TM—10711) Nuclear medicine progress report for quarter ending December 31, 1987.** Knapp, F.F., Jr.; Allred, J.F.; Ambrose, K.R.; Blystone, S.L.; Callahan, A.P.; Lisic, E.C.; McPherson, D.W.; Rice, D.E.; Rogers, C.J.; Srivastava, P.C. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015383/JAW.

The production of osmium-191 by thermal neutron irradiation of enriched osmium-190 has been further evaluated at neutron flux values from 4 {times} 10^{14} to 2.5 {times} 10^{15} neutrons/cm^2{center←dot}sec. In order to obtain osmium-191 with a specific activity of 250 mCi per mg of enriched osmium-190, irradiation periods at neutron flux values lower than 2.5 {times} 10^{15} neutrons/cm^2{center←dot}sec have to be extended up to 2--4 weeks. This results in significantly increased levels of the undesirable iridium-192. The iridium-192 is produced by capture of a neutron by iridium-191, which is formed by decay of the short-lived 4.96 sec iridium-191m daughter produced by β/sup {minus}/ decay of osmium-191. Elution of even small levels of iridium-192 from the Os-191/Ir-191m generator results in a large portion of the total absorbed radiation dose from the generator eluate. Two efficient methods for purification of osmium-191 by conversion to osmium tetroxide and isolation by both distillation and solvent extraction methods have been developed for removal of iridium-192. During this period, iodination of model nucleoside substrates has also been pursued. The reaction of iodine monochloride with imidazole nucleoside, 5-amino-1-(2,3,5-tri-O-acetyl-β-D-ribofuranosy) imidazole-4-carboxamide, provided the unexpected 2-chloroimidazolenucleoside in good yield. This could be a useful method for preparation of other chlorinated imidazoles. 23 refs., 7 figs., 7 tabs.

49646 **Regional distribution of ventilation assessed by Kr-81m scintigraphy employing temporal Fourier transform.** Slosman, D.; Susskind, H.; Cinotti, L.; van Giessen, J.W.; Brill, A.B. (Brookhaven National Lab., Upton, NY (USA)). *American Journal of Physiologic Imaging;* **1**: No. 1, 5-11(1986).

Temporal Fourier analysis was applied to Kr-81m ventilation scintigraphy to determine the amplitude (AMP1) and phase (PHA1) of the first harmonic of a single composite respiratory cycle and to

compare regional patterns in subjects with obstructive pulmonary disease (COPD) and nonobstructed subjects. Six nonobstructed subjects, three subjects with small airway disease, six subjects with COPD, and one subject with restrictive disease were investigated. The mean value of the functional PHA1 image (PHA1m) correlated negatively with 1-second forced expiratory volume (FEV1) (r = -0.801, P less than .001), with %FEV1/FVC (r = -0.636, P less than .01) and maximum midexpiratory flow rate (FEF25-75%) (r = -0.723, P less than .002), and correlated positively with residual volume (r = 0.640, P less than .01). PHA1m values for the six subjects with COPD were significantly higher (t = 2.359, P less than .05) than for the ten nonobstructed subjects. Display of phase and amplitude functional images permits a visual evaluation of the regional distribution of ventilation to be made. Regional abnormalities of air flow were detected in obstructed subjects, and the presence of airway obstruction could be predicted. Dynamic ventilation imaging, therefore, appears to be a potentially useful noninvasive technique to assess lung impairment on a localized level.

5507 Microbiology

49647 (AD-A—193411/6/XAB) Metabolic activity of bacterial cells enumerated by direct viable count. Roszak, D.B.; Colwell, R.R. (Maryland Univ., College Park (USA). Dept. of Microbiology). Dec 1987. 5p. NTIS, PC A02/MF A01.

Pub. in Applied and Environmental Microbiology, Vol. 53, No. 12, 2889-2983(Dec 1987).

The direct viable count (DVC) method was modified by incorporating radiolabeled substrates in microautoradiographic analyses to assess bacterial survival in controlled laboratory microcosms. The DVC method, which permits enumeration of culturable and nonculturable cells, discriminates those cells that are responsive to added nutrients but in which division is inhibited by the addition of nalidixic acid. The resulting elongated cells represent all viable cells; this includes those that are culturable on routine media and those that are not. Escherichia coli and Salmonella enteritidis were employed in the microcosm studies, and radiolabeled substrates included (methyl-tritium thymidine or (Uranium-Carbon 14) glutamic acid. Samples taken at selected intervals during the survival experiments were examined by epifluorescence microscopy to enumerate cells by the DVC and acridine orange direct count methods, as well as by culture methods. Good correlation was obtained for cell-associated metabolic activity, measured by microautoradiography and substrate responsiveness (by the DVC method) at various stages of survival. Of the cells responsive to nutrients by the DVC method, ca 90% were metabolically active by the microautoradiographic method. No significant difference was observed between DVC enumerations with or without added radiolabeled substrate.

49648 (CONF-880521—4) Adsorption of Sr by immobilized microorganisms. Watson, J.S.; Scott, C.D.; Faison, B.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014743/JAW.

From 10. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (16 May 1988).

Wastewaters from numerous industrial and laboratory operations can contain toxic or undesirable components such as metal ions, which must be removed before discharge to surface waters. Adsorption processes that have high removal efficiencies are attractive methods for removing such contaminants. For economic operations, it is desirable to have an adsorbent that is selective for the metal contaminant of interest, has high capacity for the contaminant, has rapid adsorption kinetics, can be economically produced, and can be regenerated to a concentrated waste product or decomposed to a low-volume waste. Selected microorganisms are potentially useful adsorbents for these applications because they can be inexpensive, have high selectivities, and have high capacities for adsorption of many heavy metals, which are often problems in a variety of industries. A laboratory-scale packed column containing microbial cells immobilized within a gelatin matrix has been prepared, and its application to removal of Sr from a simulated wastewater is described. 6 refs., 2 figs., 3 tabs.

49649 (PNFI—PI-X-30) The isolation, characterization and evaluation of Frankia strains. Normand, P.; Lalonde, M.; Fortin, J.A.; Chatarpaul, L. (Institut Forestier National de Petawawa, Chalk River, Ontario (Canada)). 1984. 50p. (CE—01737). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Osmium tetroxide (OsO/sub 4/) was used as the sterilizing agent to isolate the nitrogen-fixing endophyte Frankia from nodules of host plants. This treatment resulted in a pure culture collection of 250 Frankia isolates from several species of Alnus (crispa, rugosa, viridis, glutinosa, and serrulata) and from other actinorhizal species from Quebec. Frankia isolates from A. viridis and S. canadensis are reported in this document for the first time. Sugars from whole-cell hydrolysates of the organisms were analysed by gas liquid chromatography to identify strains previously screened on the basis of morphology and infectivity. This technique proved especially useful for those isolates whose morphology was atypical (ACN8, ArgN22, SCN9, and SCN10). It was demonstrated that sugar analysis (2-O-methy-D-mannose, in particular) can be important in resolving the taxonomy of Frankia. The nitrogen-fixing efficiency of some Frankia strains was evaluated by inoculating A. crispa. It was found that the efficiency of organisms was not influenced by the host from which they were first isolated. However, significant differences between some isolates of the same provenance occurred. It was also found that those strains of Frankia which do not sporulate were more effective in fixing nitrogen than those which do. It is proposed that the terms type P and type N be used to designate spore positive (Sp/sup +/) and spore negative (Sp/sup -/) Frankia strains, respectively. Further, it is recommended that sporulation type be used as a valid basis for species definition in the genus Frankia. 118 refs., 16 figs., 10 tabs.

5509 Pathology

REFER ALSO TO CITATION(S) 48118, 49515, 49629, 49725, 49734, 49735, 49736, 49737, 49738, 49739, 49740, 49741, 49742, 49745, 49746, 49747, 49748, 49753

49650 (AD-A—193124/5/XAB) Histopathological changes in gastrocnemius muscles of rabbits injected with HI-6 in saline. Memorandum report. Connolley-Mendoza, C.E.; Jericho, K.; Bhatti, T. (Defence Research Establishment Suffield, Ralston, Alberta (Canada)). Feb 1988. 25p. (DRES-SM—1236). NTIS, PC A03/MF A01.

The gastrocnemius muscles of rabbits were injected with HI-6 in saline. Macroscopic and histopathological examinations of injection sites and regional lymph nodes revealed that HI-6 in saline produced muscle necrosis. Macroscopic examinations of muscles injected with a low dose of HI-6 (50 mg/kg) showed no lesions on Day 7. However, histopathological examinations disclosed lesions on some animals but with evidence of healing processes by Day 7; lesions disappeared by Day 14. Further macroscopic and histopathological examinations revealed that lesions associated with the high dose (200 mg/kg) were still prominent on Day 14 but with evidence of healing. Similar lesions seen in muscles injected with saline were significantly less persistent than those associated with HI-6.

49651 (PB—88-866371/XAB) Benzene toxicity. January 1978-June 1988 (Citations from the Life Sciences Collection data base). Report for January 1978-June 1988. (National Technical Information Service, Springfield, VA (USA)). Jul 1988. 146p. NTIS PC N01/MF N01.

Supersedes PB—87-859922.

This bibliography contains citations concerning toxicity of benzene following short- and long-term exposure. The metabolism, carcinogenicity, and teratogenic potential of benzene are considered. Methodology to quantitate its presence in the atmosphere, body tissues, and body fluids are discussed. Occupational hazards of benzene are noted. (This updated bibliography contains 294 citations, 21 of which are new entries to the previous edition.)

5510 Physiological Systems

REFER ALSO TO CITATION(S) 49683

5520 Public Health

REFER ALSO TO CITATION(S) 48098, 48761, 49487, 49501, 49502, 49503, 49504, 49505, 49506, 49507, 49508, 49509, 49510, 49511, 49542, 49599, 49651, 49724, 49732, 49743, 49744, 49754, 49755, 49756, 49757, 49758, 49759, 49760, 49761, 49762, 49763

49652 **(CONF-8805176—1) Public health risk from ELF [electromagnetic fields] exposure -- can it be assessed?.** Aldrich, T.E.; Easterly, C.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88015277/JAW.

From Meeting of the International Agency for Research on Cancer; Lyon, France (2 May 1988).

Extremely low frequency electromagnetic fields (ELF) are a ubiquitous environmental agent. There are persistent indications that these fields have biologic activity, and consequently, there may be a deleterious component to their action. Epidemiologic researchers of ELF face several methodological obstacles, and quantitative risk assessment is in a quandary. Simply stated there is a need for more data—especially with regard to exposure assessment.

49653 **(PB—88-203021/XAB) Information profiles on potential occupational hazards: the ferrous smelting and steel manufacturing industry.** (Syracuse Research Corp., NY (USA). Center for Chemical Hazard Assessment). Dec 1979. 50p. (SRC-TR—79-616). NTIS, PC A03/MF A01.

See also PB—81-147555.

Information is presented on occupational hazards associated with ferrous smelting and steel manufacturing. Exposures to high temperatures through the operation of the furnaces, coke ovens, sintering and pelletizing equipment and during inprocessing and product-finishing activities resulted in burns, eye injuries, and heat stress. Exposure to chemical contaminants during the smelting and manufacturing stages was shown to cause respiratory distress and lung cancer. Among the most serious of these contaminants were benzopyrene, carbon monoxide, coal and coke dust, coke oven emissions, manganese compounds, nitrogen oxides, particulates, and sulfur oxides. Toxicological and physiological properties of chemical substances encountered during ferrous smelting and steel manufacturing were listed. Exposures to loud noise, vibration, and radiation at potentially hazardous levels were also possible. Current standards and NIOSH recommended limits for typical process materials, byproducts, emissions, additives, and impurities associated with the iron and steel industry were listed.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 48332, 48393, 49219, 49555, 49723

49654 (IAEA-TECDOC—454, pp 15-67) **Radiation sterilization of pharmaceuticals and disposable medical products.** Gopal, N.G.S.; Sharma, G.; Patel, K.M. (Bhabha Atomic Research Centre, Bombay (India). ISOMED). Apr 1988. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88703833/JAW. (CONF-8610432—).

From Advisory group meeting on technical and economic comparison of irradiation and conventional methods; Dubrovnik, Yugoslavia (6 Oct 1986).

The use of disposable products in medical care has become one of the essential tools in the prevention of cross-contamination and nosocomial infections. This is especially important in the transfer of vital diseases like hepatitis and, more recently, AIDS. The widespread use of disposables has been made possible by the availability of cheap materials (plastics) for its manufacture, the large scale/low cost production and development of industrial sterilization techniques. The emphasis here is on radiation sterilization techniques and their importance at the industrial level. Technical, economical, safety and other aspects are compared with other techniques, mainly based on the use of toxic gases. Sterilization of plastic medical products and pharmaceuticals is discussed. The comparative analysis indicates much higher reliability of radiation sterilization combined with higher safety standards at acceptable or lower cost, as compared with other techniques. (author). 169 refs, 4 tabs.

49655 (IAEA-TECDOC—454, pp 69-83) **Biological tissues for surgical implants.** Phillips, G.O. (North East Wales Inst. of Higher Education, Connah's Quay (UK). Kelsterton Coll.). Apr 1988. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88703833/JAW. (CONF-8610432—).

From Advisory group meeting on technical and economic comparison of irradiation and conventional methods; Dubrovnik, Yugoslavia (6 Oct 1986).

γ-irradiation is now being used extensively to safely and economically sterilize human and animal tissues for use in implant surgery, and the treatment of burns, particularly bone, cartilage, skin, dura mater, fascia lata and amnion. The practice of establishing Human Multi-tissue Banks is growing rapidly, and IAEA has initiated a coordinated programme to transfer this relatively low technology within South East Asia. The advantages of indigenous production for developing countries, particularly, are a reduced dependence on expensive commercial sources, and improved basic health care. Sterilization using γ-irradiation is also the method of choice for the commercial products now available. (author). 25 refs, 5 tabs.

49656 **(IAEA-TECDOC—455) Semi-dwarf cereal mutants and their use in cross-breeding III. Proceedings of the final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding held in Rome, 16-20 December 1985.** (Joint FAO/IAEA Div. of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development, Vienna (Austria)). Mar 1988. 256p. (CONF-8512153—). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW.

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

A Co-ordinated Research Programme on the "Evaluation of semi-dwarf mutants as cross-breeding material in cereals" was initiated in 1980, with the main objective to provide cereal breeders with new, alternative sources of genes for semi-dwarf, lodging resistant plant types. The present publication includes papers presented at the final Research Co-ordination Meeting. Papers presented by participants in the Co-ordinated Research Programme demonstrate that these objectives were successfully achieved. As an additional result of this programme more improved genotypes of cereals with other desirable characters as earliness, better harvest index and improved plant architecture have become available for practical breeding. Refs, figs, tabs.

49657 (IAEA-TECDOC—455, pp 9-13) **Biotechnology and mutation breeding.** Baenziger, P.S. (Monsanto Agricultural Co., Chesterfield, MO (USA)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Mutation breeding has been successful. New biotechnological techniques such as in vitro mutagenesis, in vitro selection, and haploidy may assist in, or improve mutation breeding where applicable. In vitro mutagenesis will increase the specificity of the mutation process. In vitro selection and haploidy will improve mutation identification and selection capabilities. These techniques, their uses, and their limitations are discussed. (author). 20 refs.

49658 (IAEA-TECDOC—455, pp 15-18) **Activity of the Institute of Experimental Research for Cereal Crops, Rome.** Bianchi, A. (Istituto Sperimentale per la Cerealicoltura, Rome (Italy)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

The achievements of the Istituto Sperimentale per la Cerealicoltura are briefly summarized in the presented paper. Between them the semi-dwarf wheat varieties bred by this Institute like Ardito, Villa Glori, Mentana, Damiano, Balilla and for durum species Senatore Cappelli. The present main activity of the Institute is devoted to the design of experiments, applied genetics, agronomic techniques and technology of cereal products.

49659 (IAEA-TECDOC—455, pp 19-30) **Gene manipulation by mutation techniques.** Maluszynski, M.; Sigurbjoernsson, B.; Micke, A. (Joint FAO/IAEA Div. of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development, Vienna (Austria)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

The most important results of cereal mutation breeding are presented as examples of the usefulness of techniques for crop improvement. These economically valuable results were obtained with very limited input. It was demonstrated that the mutation method, in comparison to conventional plant breeding, involved only a small number of breeders with limited facilities and financial support. The introduction of biotechnology methods in plant breeding provided an opportunity for wider implementation of mutants and mutation techniques. (author). 33 refs, 4 figs, 1 tab.

49660 (IAEA-TECDOC—455, pp 33-41) **Examination of dwarf wheats produced by mutation, crossing and physiological procedures.** Barabas, Z.; Kertesz, Z. (Cereal Research Inst., Szeged (Hungary)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

By induced mutations more than 2000 dwarf lines were produced and 1600 were examined in ear-to-row experiments in 1984-85. The new dwarf forms showed a reduction in height of 11-28 per cent as compared to the parental cultivars. By "cleaning up" the genetic background euplasmic new dwarf forms can be produced and the productivity of which reaches that of the tall ones, possibly because of the elimination of chromosome and cytoplasm aberrations. Genetic analysis of dwarf wheats verified, that in combining ability for height Mini Mano proved to be the best, reducing the height of its hybrids by more than 7 cm. As Mini Mano has a number of excellent characteristics it seems to be very promising both as a cultivar and as a crossing parent. The internode length of 45 F/sub 1/ hybrids, along with their parents, was measured in the field. Three of the parents involved (Mv 3, Godollo 1 and Godollo 2) were of mutation origin. The behaviour of Apollo cv. was very favourable. In almost all cross combinations it reduced the length of the first internodes and increased the peduncle length. Using tissue culture methods somaclonal variants in a number of characteristics have been produced. For improving the characteristics of dwarf lines, progenies of their F/sub 1/, F/sub 2/ and F/sub 3/ generations were included in the haploid breeding program. A number of androgenetic doubled haploids have been improved. More than 5.000 gametoclone and/or somaclone lines are under tests in field nurseries. Reduction of the influence of gravitation results as well in a reduction in height. (author). 10 refs, 2 figs, 4 tabs.

49661 (IAEA-TECDOC—455, pp 43-47) **Evaluation of semi-dwarf mutants in triticale and wheat breeding.** Driscoll, C.J. (Adelaide Univ., Glen Osmond (Australia). Waite Agricultural Research Inst.). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Two triticale lines, Beagle and DR - IRA were subjected to either X-rays or E.M.S. and later generation derivatives scored for height and yield. 219 single M/sub 2/ plant selections were reduced to 18 lines for replicated yield analysis, on the basis of yield in the intervening generations. Higher yielding selections appear to have been isolated; however, they are not notably shorter than the controls. Wheat Composite Crosses have been established based on the X-ray induced nuclear male-sterility mutant 'Cornerstone'. Derivatives, following three rounds of obligatory outcrossing, include high yielding lines. Composite Crosses appear to be more successful if they are homogeneous for a semi-dwarf allele. (author). 5 refs, 5 tabs.

49662 (IAEA-TECDOC—455, pp 49-56) **Evaluation of mutant stocks for semi-dwarf plant type as material for cross-breeding in durum wheat.** Filev, K.A. (Institute of Genetics, Sofia (Bulgaria)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Mutation breeding has been an important part of the durum wheat breeding programme for reduced height, lodging and cold resistance. A scheme has been tested, which makes it possible to speed up the plant breeding period and create valuable semi-dwarf durum wheat lines or cultivars. A close correlation was found between: plant height and length of the last internode, weight of grain of main spike and yield per plant, tillering and yield per plant, and number of grain of main spike and grain weight of main spike. The obtained results indicated that short stature mutant lines with different semi-dwarf genes and GA response have been created, characterized by cold and lodging resistance, high yielding potential and protein content. Some of them proved to be a valuable cross-breeding material in durum wheat, others for example, Losen 76, were directly released as a new cultivar. (author). 8 refs, 6 figs, 4 tabs.

49663 (IAEA-TECDOC—455, pp 57-68) **Exploitation of the Tom Thumb dwarfing gene, Rht3, in F/sub 1/ hybrid wheats.** Gale, M.D.; Salter, A.M.; Curtis, F.C.; Angus, W.J. (Plant Breeding Inst., Trumpington (UK); Nickerson RPB Ltd., Rothwell (UK)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Nine F/sub 1/ hybrids, all with an Rht3 dwarf female parent, were produced using the Shell chemical hybridising agent, WL 84811. Yield trials show that on average the yield potential of the F/sub 1/s exceeded that of the high yielding parent by 17 per cent. The increase in yield potential in the Rht3/rht heterozygote was brought about by an increase in grain number of 32%. The increased yields in the intervarietal F/sub 1/s were obtained by improved filling at these extra grain sites. No evidence for an effect on tiller density was found. A close correlation between heterosis for plant height and heterosis for grain yield was found between the hybrids which may provide a screen for rapid identification of high yielding F/sub 1/ combinations. A cytological examination of tall 'off-types' among the F/sub 1/s indicated the presence of a high level of aneuploidy in Rht3/rht hybrids. The causes and consequences of this chromosomal instability are discussed. (author). 6 refs, 3 figs, 5 tabs.

49664 (IAEA-TECDOC—455, pp 69-75) **Comparison of two semi-dwarfing genes on yield performance of durum wheat lines.** Giorgi, B. (ENEA-FARE, Centro Ricerche Energia, Casaccia (Italy). Div. Tecnologie Biologiche e Agrarie). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

To evaluate the effects of two different semi-dwarfing genes on yield, two cultivars of durum wheat bred at ENEA weere used. "Creso" has the Rht1 gene and is insensitive to gibberellin at seedling stage. "Tito" has reduced stature due to a semi-dominant semi-dwarf (SD) mutation induced by gamma ray and is gibberellin responsive. Sixty-six F/sub 4/ randomly selected lines coming from the cross of the above mentioned varieties were compared in agro-

nomic trials. Half of them were gibberellin insensitive, like Creso and half gibberellin responsive, like Tito. Grain yield of the SD lines was higher than that of the Rht1 lines, even though the difference was relatively small and not significant. In the subsequent generations F/sub 5/ and F/sub 6/ the best performing lines of these two semi-dwarf types gave on the average the same yield results; thus showing that the reduced height mutation (SD) appears as good as the Rht1 gene for breeding purposes. However, it has to be taken into account that the difference in plant height in favour of the taller SD lines (about 15 cm) may compensate for the Rht1 effect based on the positive yield-plant height correlation. (author). 4 refs, 5 tabs.

49665 (IAEA-TECDOC—455, pp 77-94) **Genetic analysis, genetic improvement and evaluation of induced semi-dwarf mutants in wheat.** Konzak, C.F. (Washington State Univ., Pullman (USA). Dept. of Agronomy and Soils). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Recent results from breeding studies in T. aestivum wheats indicate that improved high yielding recombinants that carry the reduced height gene Rht13 from the semi-dwarf mutant Magnif 41 M1 in combination with Rht2 have been isolated. These improved lines should be useful in further breeding. In genetic analyses, additional data have confirmed that the reduced height gene Rht12 from the mutant Karcag 522M7K is strongly dominant, while typical epistatic, partially additive interactions may occur with other Rht genes and recombinations with different Rht or reduced height alleles can produce taller or shorter derivatives. Thus, the degree of dominance or recessiveness of Rht genes appears to be a continuum, with their expression in crosses further modified by epistatic interactions with other Rht alleles. Mutant Burt M860 was found to carry a new mutant gene Rht20 that is partially dominant for reduced height. The reduced height gene Rht11 of Bezostaja dwarf mutant Karlik-1 was largely recessive in the four combinations studied. In T. turgidum durum, the partially dominant Rht14 gene of 'Castelporziano' showed independent inheritance from Rht1. The inheritance of two other partially dominant induced mutant genes, respectively Rht16 of Edmore SD1 and Rht18, of 'Icaro' (from E.N.E.A., Italy) differed from Rht1 and Rht14. The Rht15 locus of 'Durox' showed less dominance than Rht14, and the two genes were independently inherited. Significant new useful genetic variation for breeding improved semi-dwarf bread and durum wheat cultivars has been induced. These mutants offer breeders greater freedom in choosing Rht genes and combinations for cross-breeding to control straw height and lodging and to improve harvest index. (author). 17 refs, 15 figs, 2 tabs.

49666 (IAEA-TECDOC—455, pp 95-101) **Barley mutants in relation to culm length.** Lundqvist, U. (Svaloef, AB, Svaloev (Sweden)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

The semi-dwarf type in barley is very heterogeneous, reduced culm length being more or less characteristical of a number of different groups of mutants in barley at the side of the short culm mutants proper. Thus, short culm may occur associated with the mutant characters erectoides (short spikes), praematurum (early), globosum (rounded seeds), upright, and strawstiff. Covariation studies of 111 mutants in the five ert-loci ert-a, -b, -c, -d, and -e showed a positive correlation between culm length and yielding ability. The patterns of distribution differ among the loci; but favourable deviants of semi-dwarf type are indicated for all five loci. For the three main mat-loci mat-a, -b, and -c, no correlation between culm length and yielding ability was shown; mutants in mat-a generally had shorter culm length. Thus, mutants of the praematurum type compared with mutants of the erectoides type may offer more favourable materials for selecting high-yielding semi-dwarf types. Among the 52 short culm mutants, those with extreme reduction of culm length showed, without exception, strong reduction of yield. Among the 23 strawstiff mutants, on the other hand, the majority, even among the shortest ones, exceeded the average yield of the mother variety. In an M/sub 2/ material of cv Sv Frida, sodium azide compared with neutrons turned out to be clearly more efficient to produce short culm M/sub 3/ lines. In studies of mutations affecting the development of lateral florets in the three two-row cv Sv Bonus, Sv Foma, and Sv Kristina single mutants of intermedium type showed no effect on culm length and maintained the varietal differences. Double int mutants, irrespective of their being derived from cross combinations within a variety or between varieties showed a marked reduction of culm length. Triple mutants, with the additional contribution of a six-row gene from locus hex-v, showed an apparent increase in culm length.

49667 (IAEA-TECDOC—455, pp 103-124) **Agronomic and genetic evaluation of induced mutants of White Luchai-112.** Narahari, P. (Bhabha Atomic Research Centre, Bombay (India)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Early mutants induced in the photo-sensitive, tall and fine-grained variety White Luchai-112 (WL.112) continued to show promise when tested in the region where the parent variety is popularly grown. Earliness in one such mutant is found to be governed by a gene system different from that of another early, semi-dwarf, long-slender grained and high yielding lines, TR-17. Several hundred selections combining desirable traits have been obtained in the progeny of the cross involving these two early parents. Differences in culm height, number of internodes and pattern of internode elongation and thickness were observed in the promising reduced height non-lodging mutants of WL.112. Studies upto F/sub 2/ in 21 crosses involving 13 mutants of WL. 112 and 9 genetic stocks have revealed the following. Among the mutants, two carry the same dwarfing gene sd/sub 1/ as that of Dee-geo-woo-gen while three others have its dominant allele. The remaining eight mutants are governed by seven single genes tentatively designated as sd/sub x1/ to sd/sub x7/, sd/sub x1/ being common in two mutants and non-allelic to sd/sub x2/; one gene sd/sub x6/ is non-allelic to sd/sub 1/ ; four genes sd/sub x3/, sd/sub x4/, sd/sub x5/ and sd/sub x7/ are non-allelic to the dwarfing gene d/sub t/ of TR-5, one gene sd/sub x4/ is non-allelic to sd/sub x/, of Cheng-chu-ai-11. Among the remaining genetic stocks the sd/sub 2/ gene of D66 is non-allelic to sd/sub x'/, similarly sd/sub x''/ of Tainan-5 is non-allelic to d/sub t/ while both d/sub x'/, and d/sub t/ are present in IR-28 dwarf. (author). 5 refs, 24 figs, 2 tabs.

49668 (IAEA-TECDOC—455, pp 125-133) **Evaluation, inheritance, and Gibberellin response of induced semi-dwarf mutants of rice.** Rutger, J.N.; Anderson, T.R. (California Univ., Davis (USA). Dept. of Agriculture). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

The induced semidwarf mutant gene, sd/sub 1/, has been used to develop nine rice cultivars in California. This induced mutant gene is allelic to the semidwarfing gene in DGWG, T(N)1, IR8, and other Green Revolution cultivars. Six other mutants are non-allelic to sd/sub 1/. To date, none of these six has been as agronomically useful as sd/sub 1/, but three warrant further investigation if genetic vulnerability should arise from widespread usage of sd/sub 1/. Seedling response of genotypes to exogenous gibberellin (GA) fell into three broad categories: High response (second leaf sheath length at 10 ppm of GA more than 450% of control), intermediate response (300-450%), and low response (less than 300%). The high response category consisted of Tanginbozu and the semidwarf mutant Short Labelle. The low response category consisted of the tall indica cultivar Peta and the tall southern US cultivar Labelle. The remaining genotypes, including the semidwarf indica cultivar DGWG, the two tall japonica cultivars Calrose and M5, three japonica semidwarfs with the induced mutant gene sd/sub 1/, the indica-japonica derived semidwarf cultivar M9, and the other 8 induced semidwarfs, showed intermediate response. The

major semidwarfing gene sd/sub 1/, whether derived from induced mutation or from the DGWG source, does not seem to affect GA-response in japonica backgrounds. In contrast, in indica backgrounds the sd/sub 1/ gene is associated with increases in GA-responsiveness. The implications of GA responsiveness of semidwarfs in rice breeding remain unclear. (author). 9 refs, 5 figs, 1 tab.

49669 (IAEA-TECDOC—455, pp 135-144) **Mutation breeding for semi-dwarfism in barley.** Ullrich, S.E.; Aydin, A. (Washington State Univ., Pullman (USA). Dept. of Agronomy and Soils). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Mutation breeding has been an important part of the barley breeding effort for reduced height and lodging resistance at Washington State University. Between 1980 and 1985, 264 sodium azide induced putative semi-dwarf mutants have been selected in the M/sub 2/ from 19 spring genotypes. Most have been discarded due to serious defects. Fifteen mutants were chosen for genetic analysis and agronomic evaluation to determine their usefulness for cross-breeding or even as potential cultivars. In addition to reduced culm length (65-88% vs normal), most mutants had similar or reduced culm diameters, while one mutant had larger culm diameters compared to their normal isotypes. Coleoptile lengths varied similarly. Six of these mutants are presented here as representative of the range of mutants studied. All mutants appear to carry a single recessive gene for semi-dwarfism. Most non-allelic mutant crosses gave 9:7 F/sub 2/ ratios, while one combination produced a double dwarf indicating additive gene interaction. Two of the mutants are erectoides (ert) types, and the rest appear to be sdw, semi-dwarf types. An incomplete diallele cross series revealed some allelic, but mostly non-allelic gene relationships. Mutant agronomic performance was variable, but most mutants were lower in yield than their respective normal isotypes. The mutant, Mo1, in 'Morex' was 19% higher in yield than Morex. Kernel quality (density, plumpness) tended to be lower in most of the mutants. Lodging was reduced in most mutants but not in all. Whereas some of the mutants appeared to be improved for several agronomic traits such as lodging resistance, yield and earliness none combined all the traits necessary for a new improved cultivar. The mutants, Mo1 and Mo4 in Morex and L2 in 'Larker' should be good parents for cross-breeding especially for lodging resistance or earliness.

49670 (IAEA-TECDOC—455, pp 145-148) **Selection of cold tolerant mutant lines in naked barley (Hordeum vulgare L.).** Won, J.L.; Chung, G.H. (Gyeonsang National Univ., Jinju (Republic of Korea)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

In order to screen the cold tolerant mutant lines in naked barley, seeds of recommended variety Baekdong were treated with X-rays of 25 kR. Two cold tolerant mutant lines were selected under field conditions with the lowest winter temperature being from -13 deg. C to -20 deg. C, during M/sub 2/ to M/sub 5/ generations. The number of vascular bundles of cold tolerant mutant line BM-5 was decreased and culm diameter was thicker than that of the parent line. Important characters of cold tolerant mutant line BM-5 were similar to those of the parent line. (author). 6 refs, 1 fig., 3 tabs.

49671 (IAEA-TECDOC—455, pp 149-162) **Genetic analysis of induced semi-dwarf mutants in rice.** Yamagata, H.; Tanisaka, T.; Tomita, M.; Shiraishi, K. (Kyoto Univ. (Japan). Faculty of Agriculture). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

A number of semi-dwarf mutants of rice were evaluated for 15 agronomic characters laying stress on plant type and grain yield, and some of them were genetically analyzed for the genes controlling the semi-dwarfness. 1) Principal component analysis for 14 characters revealed that various plant types of semi-dwarf mutants could easily be induced by mutagenic treatment, and the pattern of induced plant type was largely affected by the genotype of the original variety. Grain yield of the induced mutants tended to be higher in the mutants with larger "general size" irrespective of the original variety, but did not show particular relationship to the culm trait as represented by both internode elongation and culm thickness. 2) Five of the nine induced semi-dwarf mutants analyzed were each proved to be controlled by single semi-dwarfing gene, and these mutated genes were considered to be non-allelic to each other. Among the remaining four, one carried two semi-dwarfing genes and three were brought by the mutations in minor gene system. 3) Based on the above results, the high possibility was indicated for creating new semi-dwarfing gene resources for breeding, and the necessity was pointed out for appropriate choice of materials to be adopted and analysis of both induced and existing semi-dwarfing genes. (author). 8 refs, 7 figs, 4 tabs.

49672 (IAEA-TECDOC—455, pp 165-176) **Transfer of alien genes into cultivated wheat and triticale genotypes by the use of homoeologous pairing mutants.** Ceoloni, C. (ENEA-FARE, Centro Ricerche Energia, Casaccia (Italy). Div. Tecnologie Biologiche e Agrarie). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Alien species, both wild and cultivated, can greatly help in broadening the genetic base of presently cultivated wheats, thanks to the large reservoir of useful genes they contain. However, introduction of substantial portions of alien genomes into cultivated genotypes in most cases makes them unfit for commercial use, due to the contemporary presence of positive and negative traits carried by the alien material. Therefore, what appears to be generally needed is to obtain transfers that include the shortest possible alien segment(s). Preliminary results are reported here of a work aimed at transferring to common wheat a gene for resistance to powdery mildew derived from Triticum longissimum, a diploid species with a very closely related genome to the B genome of polyploid wheats. As donor line a T. longissimum ditelosomic addition to Chinese Spring was used. The alien telo, bearing the resistance gene(s), corresponded to the short arm of chromosome G, whose homoeology with the group-3 chromosomes of common wheat had been established. A transfer scheme has been adopted that, within two generations of crosses, of which one with the ph1 mutant of Chinese Spring, provided plants having in single dose the alien telocentric, its wheat homoeologue and a 5B/ph1 chromosome. Such plants were then pollinated by the standard euploid for the recovery of recombinant types. The frequency of recombinant resistant plants detected so far suggests that the pairing frequency between the alien telo and its wheat homoeologues was quite high, most probably ranging between 25 and 30%, on an average. Extensive use is also being made of the ph1 6X triticale as one the parents in various wide crosses with different D genome sources, including common wheat and synthetic amphiploids. The results show that the ph1 mediated recombination is a promising method for triticale improvement. 18 refs, 1 fig, 2 tabs.

49673 (IAEA-TECDOC—455, pp 177-182) **Effect of gamma radiation on immature wheat embryo culture.** Gao Mingwei; Liang Zhuging; Chen Ziongying. (Zhejiang Agricultural Univ., Hangzhou (China)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

The possibility of using in vitro cultures of common wheat in connection with mutagenic treatment is discussed. Seeds, pro and young embryos and callus were irradiated with various doses of gamma rays. The observed variation in the awn types is suggested as an indicator of the mutagenic effect in this combined treatment. The variants frequency for the pooled M/sub 1/ donors in S/sub

1/ generation was about 14% in comparison to 6% of the in vitro control and over the usual frequency for awning mutation in M/sub 2/ and M/sub 3/ generations in wheat. (author). 7 refs, 3 tabs.

49674 (IAEA-TECDOC—455, pp 183-191) **In vitro culture in barley breeding.** Kao, K.N. (National Research Council of Canada, Saskatoon, Saskatchewan (Canada). Plant Biotechnology Inst.). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

One of the most useful biotechnics for plant breeders is in vitro culture of anthers or miscropores to induce haploids and homozygous diploids. High frequency of microspore-derived diploid plants could be produced by culturing anthers on Ficoll medium. The segregation ratios of certain morphological characters were not random and could be shifted by culture conditions. It was reported by a number of authors that true breeding and highly productive genotypes were obtained from microspore-derived diploid plants and doubled haploids derived from bulbosom techniques. There is a great possibility that a selective system for desirable characters can be built in an in vitro culture system. Where haploids can be induced in crop plants, they provide the most rapid technique for producing homozygous lines. Since the genetically controlled factors in homozygous lines are fixed and will be identical in the future generations, it becomes possible for a plant breeder to evaluate quantitative characters such as yield and quality very early in the breeding program. There are two methods which have been used extensively for production of homozygous diploid barley plants. They are bulbosum techniques and anther culture methods. (author). 14 refs, 5 tabs.

49675 (IAEA-TECDOC—455, pp 193-206) **Semi-dwarf mutants and heterosis in barley. 1. The use of barley sd-mutants for hybrid breeding.** Maluszynski, M.; Szarejko, I.; Fuglewicz, A.; Kucharska, M.; Madajewski, R. (Joint FAO/IAEA Div. of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development, Vienna (Austria); Silesia Univ., Katowice (Poland). Dept. of Genetics; Plant Breeding Station, Polanowice-Lagiewniki (Poland)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Short stature, spring barley mutants obtained after chemical or physical mutagenic treatment were evaluated as a possible source of dwarfism in barley. Genetic analysis of 35 mutants indicated non-allelic relationships. Two dwarfing genes dw-1 and sdw-b were localized on chromosome 3. It was observed that out of 190 various morphological, physiological or isoenzymatic mutants, 122 were mutated simultaneously also for semi-dwarf or dwarf stature. In many crosses between mutants or between mutants and parents, a very high heterosis was observed. The heterosis manifestation in F/sub 1/ was observed for four characters: height, tillering or number and weight of grain per plant. The use of induced semi-dwarfs as an alternative for hybrid barley production is discussed. (author). 32 refs, 1 fig., 13 tabs.

49676 (IAEA-TECDOC—455, pp 207-210) **Biochemical aspects of cold and heat shock response in barley.** Marmiroli, N.; Komjanc, M.; Lorenzoni, C.; Odoardi, M.; Terzi, V.; Stanca, A.M. (Parma Univ. (Italy). Inst. of Genetics; Piancenza Univ. (Italy). Inst. of Botany and Plant Genetics; Experimental Inst. for Cereal Research, Fiorenzuola d'Arda (Italy)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Studies with barley plantlets (cv. Onice) showed the appearance of at least five major proteins (MW = 22, 47, 70, 85, 94 Kd) after a temperature shift up (heat shock) from 24 deg. to 40 deg. C. The synthesis of these heat shock proteins has been related with acclimation or thermoprotection of barley seedlings to elevated temperatures. We have also analyzed the modifications in proteins synthesis following a temperature shift-down from 24 deg. to 0 deg. C. (cold shock). The synthesis of three to five polypeptides (cold shock polypeptides, CSP) was obtained under this condition. Synthesis of these CSP was followed in different parts of the same plant and in two different cultivars: Onice and Georgie. The identification of specific HSPs and CSPs could offer the opportunity to clone some of their structural genes by complementary DNA synthesis, and to analyze in the molecular details their genetic regulation and their dependence on the specific genes. (author). 12 refs.

49677 (IAEA-TECDOC—455, pp 211-218) **Physiological tests for drought tolerance in barley and durum wheat.** Martiniello, P.; Boggini, G. (Istituto Sperimentale per la Cerealicoltura, Fiorenzuola d'Arda (Italy); Istituto Sperimentale per la Cerealicoltura, Catania (Italy)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Physiological tests for characterizing drought tolerance in barley (H. vulgare L.) and durum wheat (T. durum L.) were evaluated. These tests involved: 1) germination in osmotic solution (-13 atm by d-mannitol); 2) thermal stress on seedlings (42 deg. C for 5 hours); 3) stability of the cellular membrane under osmotic stress (PEG 6000 at 43%). For both species genotypic variability which was associated with drought tolerance in the field was identified by the laboratory evaluation techniques. Based on these procedures, the two-row barley types were more drought tolerant than six-row types. In durum wheat, only some local populations and some varieties, bred in drought environments, showed high laboratory test values. Weak and not significant correlations were found between the physiological tests indicating that the genetic mechanisms which control these traits may be independent and process-specific. Yield trials, in barley, have been carried out in environments with drought conditions and the correlation between grain and physiological tests were significant. Of the three procedures evaluated in this study, the dry matter increase after a period of thermal stress and electrolyte leakage seemed to be most reliable and potentially useful for screening for drought tolerance in barley and durum wheat. (author). 13 refs, 6 tabs.

49678 (IAEA-TECDOC—455, pp 219-229) **Comparative analysis at the morphological, biochemical and genetic level to develop a strategy for studying biological similarities in Triticinae.** Montebove, L.; De Pace, C. (Tuscia Univ., Viterbo (Italy). Agricultural Biology Inst.). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

The current affinities ascertained among Triticinae species are reviewed. The search of a strategy to ascertain biological similarity among Triticinae species is still a debated issue. The best approach to be used must exclude analogies as deceptive and affinities be constructed only on homologies. Previous morphological studies ascertained that the genera Secale and Dasypyrum were different from each other, and both were different from Triticum and Aegilops. However more recent cytological studies showed that certain rye chromosomes are homoeologous to that of wheat; cytoplasm studies indicated that Dasypyrum villosum cytoplasm is affine to that of the donor of the S or B cytoplasm to wheat; isoenzyme proteins and seed storage proteins pointed out to the presence in D. villosum of genes orthologous to those in the A or B genome of wheat. Definitive answers on species affinities have been obtained in few cases when in vitro DNA-DNA hybridization techniques have been used. Therefore for future work it will be interesting to use pairwise DNA-DNA hybridization of representative species of all Triticinae genera in order to have a broad and significant answer on the biological similarities of the species belonging to this subtribe. (author). 25 refs, 4 tabs.

49679 (IAEA-TECDOC—455, pp 231-240) **Agronomic evaluation of induced semi-dwarf mutants in durum and common wheat.** Mosconi, C.; Giorgi, B. (ENEA-FARE, Centro Ricerche Energia, Casaccia (Italy). Div. Tecnologie Biologiche e Agrarie). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

The durum wheat cuhivar "Anhinga" and two cultivars of common wheat "Anza" and "N. Strampelli" were irradiated with fast neutrons to induce short straw mutants with greater lodging resistance and yield potential. From a total of about 4,000 irradiated seeds 1,702 M/sub 1/ plants were harvested. These gave rise to a population of about 25,000 M/sub 2/ plants among which 1,010 plants were isolated as potential mutants showing promising agronomic characters. Following progeny tests and selection 280 true-breeding mutants entered preliminary yield trials. After several years of testing only two lines: one of durum wheat and one of common wheat showed a higher yield potential than the control varieties. In particular the durum wheat mutant (FM 027), after 7 years of field trials spread over 10 selected places, outyielded the cv. "Creso" (the leading variety in Central Italy) by about 13.6%. The mutant fD 14 from Anza after 5 years of testing in 8 locations, performed on the average better than the mother variety and outyielded the standard cv. "Orso" by 12.1%. These two lines have been submitted for registration in the National Register of Varieties. Other mutants are being used for cross-breeding. (author). 5 refs, 8 tabs.

49680 (IAEA-TECDOC—455, pp 241-246) **Semi-dwarf mutants and heterosis in barley. II. Interaction between several mutant genes responsible for dwarfism in barley.** Szarejko, I.; Nawrot, M.; Skawinska-Zydron, B.; Maluszynski, M. (Silesia Univ., Katowice (Poland). Dept. of Genetics; Joint FAO/IAEA Div. of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development, Vienna (Austria)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Dwarf and semi-dwarf mutants obtained after mutagenic treatment were chosen as material for genetic investigation of this character. A non-allelic relationship was found among six analysed mutants. The interaction was observed between all analysed genes responsible for dwarfness, including uz and br genes. It was demonstrated that expression and interaction of dwarfing genes strongly depend on the genetic background of recombinants. (author). 21 refs, 1 fig., 2 tabs.

49681 (IAEA-TECDOC—455, pp 247-249) **Effect of the rye mutant EM1 dwarfing gene on octo- and hexaploid triticale. Preliminary report.** Wolski, T.; Tymieniecka, E. (Laski Plant Breeding Station (Poland)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Preliminary results presented show a strong influence of the EM1 rye dwarfing gene on plant height of octoploid triticale and on F/sub 2/ hexaploid cross progenies. The possible use of this source in triticale breeding is briefly discussed. (author). 4 refs, 2 tabs.

49682 (IAEA-TECDOC—455, pp 251-254) **Winter triticale breeding in Poland.** Wolski, T. (Poznanska Hodowla Roslin, Warsaw (Poland)). Mar 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88703834/JAW. (CONF-8512153—).

From Final research co-ordination meeting on evaluation of semi-dwarf cereal mutants for cross-breeding; Rome, Italy (16 Dec 1985).

Winter triticale is becoming an important cereal crop in Poland, as its acreage is expected to reach 1 million ha in 1990. It is to occupy a large part of the rye growing area. Three cultivars are registered and 11 more are under official trials. The actual state of breeding in connection with the main goals is presented. Breeding methods leading to further progress are briefly discussed. (author). 4 refs, 1 tab.

49683 (INIS-BR—1147-Vol.3, pp 331-338) **Determination of the retention time of feed in rumen using Sc-46 tracer.** Nadai, E.A. de; Castro, F.B. de; Barros Ferraz, E.S. de; Machado, P.F.; Nascimento Filho, V.F. do; Pessenda, L.C.R. (Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil); Sao Paulo Univ., Piracicaba (Brazil). Escola Superior de Agricultura Luiz de Queiroz). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The retention time of fibrous feed materials in rumen is of prime importance by providing parameters to evaluate its nutritional value. Some existing marker methods have been presenting serious problems such as physico-chemical alterations of feedstuff during the treatment and also marker migration in rumen conditions. In this study, the rare-earth element Scandium-46 has been applied to marking sugarcane bagasse physically processed. The data showed no significant migration of marker to liquid phase. The retention time in the rumen fistulated cow was 23.06 hours. Correlation coefficient of elapsed time after marking with logarithm of specific activity of ruminal content was 0.9986**.

49684 (INIS-BR—1147-Vol.3, pp 361-367) **Effect of gamma irradiation from cobalt - 60 on size of the bean seed (Phaseolus vulgaris L).** Navarra A, W. (Universidad Nacional, Heredia (Costa Rica). Escuela de Ciencias Agrarias). 1988. (In Spanish). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Seeds of common bean (Phaseolus vulgaris L.) were exposed to gamma rays from a cobalt-60 source. In the first generation, one plant was isolated, which produced seeds bigger than those of the original population. Thus, 25 seeds from the mutant plant occupied a volume of 17.5 cc and wighed 15,53 grams where'as the same number of normal seeds occupied a volume of 8.0 cc and weighed 5.45 grams. A comparison of electrophonetic patterns of the mutant and normal plants was carried out and an extra double band was found in the pattern of the mutant.

49685 (INIS-BR—1147-Vol.3, pp 369-376) **Radiotracer studies on maneb in tomato fruit under tropical field conditions in Brazil.** Musumeci, M.R.; Ruegg, E.F.; Viliotti, W.M. (Instituto Biologico, Sao Paulo (Brazil). Centro de Radioisotopos). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The metabolism of maneb in ETU was studied in tomato fruits sprayed with /sup 14/C-maneb, under field conditions in Brazil, according to the local practice. The residual fungicides and ethylenethiourea were measured in the fruits at 0, 7, 15, 21, 28, 35 and 70 days after the first /sup 14/C-maneb spray. The levels of residues declined with time, and /sup 14/C-ETU was detected at 35 days in a concentration of 0.01 ppm.

49686 (INIS-BR—1147-Vol.3, pp 223-231) **Effect of the irradiation on Salmonella enteretidis var. typhimurium with gamma rays from /sup 60/Co.** Maliska, C.; Norberg, A.N.; Norberg, J.B.M.; Santos Souza, R.C. dos; Silva Tavares, P.R. da. (Hospital Central do Exercito, Rio de Janeiro (Brazil). Servico de Medicina Nuclear). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The use of ionizing radiation for destruction of microrganisms responsible for food deterioration, and food poisioning is a peaceful use of nuclear energy. The feeding toxinfections are, among us, produced in their most part by Salmonella enteritidis var. typhimurim. One hundred nineteen samples of milk containing about 150.000 bacteria per ml, by means doses ranging from 100 to 1.100 gy, two samples of surviving bacteria were again irradiated by doses up to 2.5000 Gy. The bacteria not previously irradiated were throughly killed by means of doses of 1.100 Gy. Salmonella enteritidis var. typhimurium was inactivated by means of 1.200 and 1.900 Gy doses. It was concluded that 60-Cobalt gamma radiation minimal lethal dose to Salmonella enteritidis var. typhimurium is 1.200 Gy; the re-irradiation to the survivors prompts the forthcoming of more resistant germs.

49687 **(INIS-BR—1147-Vol.3, pp 349-352) 'In vitro' determination of the rate of /sup 32/P uptake by erythrocytes.** Silva Filho, J.C.; Vitti, D.M.S.S.; Abdalla, A.L. (Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

An "in vitro" methodology based on /sup 32/p uptake by erythrocytes was established as a potential method for a phosphorus sub-clinical deficiency diagnosis in ruminant. Blood samples stored up to 48 hours were incubated with /sup 32/p at different periods and temperatures. There was no effect of storage time and the greatest /sup 32/p uptake values were obtained with incubation over 2 hours at 38 to 50/sup 0/C.

49688 **(INIS-BR—1147-Vol.3) Proceedings of the 2. General Congress of Nuclear Energy. Vol. 3.** (Associacao Brasileira de Energia Nuclear, Rio de Janeiro). 1988. 498p. (In Portuguese). (CONF-880440—). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW.

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

In this volume, papers on: radiation protection, nuclear medicine, radiobiology; radioagronomy, and radioecology, are presented. (M.C.K.).

49689 **(INIS-BR—1216) Movement and leaching losses of N-CO(/sup 15/NH/sub 2/)/sub 2/ fertilizer in a alfisol under a corn crop (Zea mays, L.).** Araujo Silva, J.C. de. (Sao Paulo Univ., Piracicaba (Brazil). Escola Superior de Agricultura Luiz de Queiroz). 1982. 74p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704008/JAW.

In an oxid Paleudalf (Terra Roxa Estruturada) the nitrogen leaching losses are studied in a corn crop (Zea mays, L.) during one growing cycle (from 1979 October to 1980 February), through the study of soil water dynamics. The complete crop water balance is established using Hg manometer tensiometers. The variations of the NO/sup -//sub 3/-N concentration with the time and soil depth (60, 90 and 120cm) were followed by ceramic porous cup samples, some suggestions about the use of tensiometers and oil solutions samplers are presented, as well as, an apendice methodology used to determine the soil water conduction coefficients. (M.A.C.).

49690 **(NEI-NO—51) Effect of gastric anacidity on the intestinal absorption of liver bound /sup 57/Co-labelled cobalamins.** Kittang, E. (Aker Sykehus, Oslo (Norway); Oslo Univ. (Norway)). 1987. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754748/JAW.

/sup 57/Co-labelled cyanocobalamin injected in rabbit was transformed within the liver to /sup 57/Co-labelled desoxyadenosylcobalamin and methylcovalamin. The absorption of /sup 57/Co-labelled liver bound cobalamins could be determined with acceptable accuracy by the double isotope fecal excretion method. Treatment with the H 2-receptor antagonist, ranitidine, did not result in decreased absorption of /sup 57/Co-labelled liver bound cobalamins in healthy individuals. R-protein and the R-proteincobalamin complex were determined by the FPLC Mono S chromatography method with a high degree of correlation to the charcoal method in saliva, gastric and duodenal juice, and with a high degree of reproducibility. Omeprazole markedly inhibited the gastric acid and pepsin secretion, but did nor inhibit the IF secretion. Omeprazole treatment resulted in anacidity in 14 of 17 individuals, but did not reduce the absorption of liver bound /sup 57/Co-labelled cobalamins. The intrinsic factor concentration in gastric aspirates measured during the study was unchanged during omeprazole treatment. The release of cobalamins from liver homogenate was markedly inhibited by neutralized gastric juice in vitro, probably due to decreased pepsin mediated proteolysis. In vivo the cobalamin release from liver homogenate was modestly inhibited in the stomach but was unaffected in jejunum during omeprazole treatment. The major part of /sup 57/Co-labelled liver cobalamins bound to R-protein in acid and neutral gastric juice in vitro, and omeprazole induced anacidity, did not influence the cobalamin binding either in gastric or jejunal juice in vivo. Reprints of six previously published papers; 63 refs.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 49684

49691 **(AD-A—193139/3/XAB) Primary screening of potential radioprotective agents. Annual report, 30 September 1986-29 September 1987.** Sigdestad, C.P. (Louisville Univ., KY (USA). Dept. of Radiation Oncology). 1 Oct 1987. 52p. NTIS, PC A04/MF A01.

This report deals with primary screening of potential radiation-protective agents. The drugs to be tested were provided by the U.S. Army Medical Research and Development Command, Fort Detrick, Maryland. The compounds were tested in toxicity screens to determine the maximum tolerated dose (MTD) effects. Limited available drug amounts precluded more refined testing. The second screen involved Cobalt-60 gamma radiation. The agents to be tested were injected intraperitoneally into CDI female Swiss mice, thirty minutes prior to irradiation with either 9.0 or 9.5 Gy. The latter value was found to be the radiation LD100(30) for this mouse strain. Survival was measured and the degree of protection was determined. Dose modification factors were determined on a limited number of agents as directed by the COR.

49692 **(AD-A—193180/7/XAB) Forms for documenting radiation safety programs. Final report.** Weed, R.; Donovan, L. (Medical Center, Scott AFB, IL (USA)). Jan 1988. 78p. (USAFMCS/TR—88/001). NTIS, PC A05/MF A01.

The Department of Radiology, US Air Force Scott Medical Center, created and compiled this booklet of document forms in Quality Assurance/Risk Management and ALARA (as low as reasonably achievable) for Nuclear Medicine/Radiology Departments. A health physicist manages, evaluates, trial tests, and currently uses forms such as these. They can be altered or easily redesigned as the needs of radiation-surveillance programs change. These Documental Forms for Ionizing Radiation (Formless Forms) should be useful for facilities that devise their own Nuclear Medicine/Radiology Quality Assurance-Risk Management and ALARA Programs.

49693 **(AD-A—193629/3/XAB) Physiological mechanisms of acute intestinal radiation death. Technical report, 1 June 1983-1 June 1986.** Jackson, K.L.; Geraci, J.P. (Washington Univ., Seattle (USA). Dept. of Environmental Health). 1 Jun 1986. 114p. NTIS, PC A06/MF A01.

The overall objective was to clarify the role of fluid and electrolyte loss, bile-duct ligation, radiation-damaged intestinal mucosa, bacterial toxemia and their interrelationships on radiation-induced gastrointestinal death. Using specific pathogen-free CD-1 male rats, this study found that endogenous enteric bacteria did not play a significant role in pure intestinal radiation death. Bile acids, per se, were shown to play little role in intestinal radiation death, but the inability of the denuded mucosa to absorb fluid and electrolytes, thereby producing hypovolemic shock, was the major mechanism.

49694 **(AD-A—194102/0/XAB) Emetic mechanism in acute radiation sickness. Technical report, 1 December 1982-30 November 1986.** Borison, H.L. (Dartmouth Coll., Hanover, NH (USA). Medical School). 20 Aug 1987. 58p. NTIS, PC A04/MF A01.

A dose-response relationship was established in normal cats for the evocation of vomiting within 24 h after whole-body exposure to ^{60}Co radiation with doses ranging from 7.5 to 60 Gy delivered at 1.0 Gy/min. Vomiting was recorded oscillographically. Radiation-induced vomiting was elicited unabatedly at the optimal dose of 45 Gy in chronically postremectomized cats. Radioemetic susceptibility was evaluated in normal cats after each of two doses of radiation, from 7.5 to 60 Gy, given on successive days. Occurrence of radioemetic protection against the second irradiation was manifested in direct relation to the magnitude of the first exposure, and complete protection for 24 h resulted after second radiation exposure at the highest dose level. Postremectomized cats were also fully protected against the radioemetic effect of a second exposure at 45 Gy. All normal cats vomited in response to an emetic drug injection during the state of radioemetic refractoriness after the second irradiation at 45 Gy. A neural origin of emetic signal generated by first radiation exposure was examined in postrema-intact cats.

49695 **(BNL—41435) Measurement of DNA damage using agarose gel electrophoresis and electronic imaging.** Sutherland, J.C.; Bergman, A.M.; Chen, Chun-Zhang; Monteleone, D.C.; Trunk, J.; Sutherland, B.M. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 14p. (CONF-880777—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013764/JAW.

From 6. meeting of the International Electrophoresis Society; Copenhagen, Denmark (4 Jul 1988).

Damage done to DNA by ultraviolet (uv) light, gamma rays and other carcinogens can be quantified using agarose gel electrophororesis. Agents that either produce strand breaks directly or that produce lesions that can be enzymatically or chemically converted to strand breaks can be studied. The method requires: (1) accurate measurement of the disribution of mass of DNA as a function of the distance of migration in the gel, (2) determination of the dispersion function of the electrophoresis system and (3) calculation of weighted averages of these functions by a computer. Less than 50 ng of DNA are required and the DNA need not be labeled with a radioactive tracer. Hence, the damage and repair of DNA in nondividing cells and intact organisms—including humans—can be studied. Initial applications have focused on the quantitation of cyclobutyl pyrimidine dimers in the DNA of uv irradiated human skin. The sensitivity of lesion detection is increased by unidirectional pulsed field electrophoresis and other methods that separate longer DNA molecules. Replacing photographic detection of ethidium fluorescence by electronic imaging increases the accuracy of the measurement and the speed of data analysis. Quantitative electronic imaging of gel fluorescence offers advantages over photography in other areas of molecular biology, medicine and biotechnology. 26 refs., 5 figs.

49696 **(CEA-R—5446) Comparison of the radiological and chemical detriments in man.** Maximilien, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire). Apr 1988. 82p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754724/JAW.

Following a review of the knowledge on the assessment of chemical carcinogens, a comparison between chemical and radiological detriments is attempted from a methodological standpoint. The main problem in chemical carcinogenesis is to get proofs, the discussion bearing on the identity of the interspecific biological mechanisms on account of the nearly constant lack of epidemiological data. The quantification of the neoplastic effects of chemical agents has not been fully developed and can be considered case by case only by carrying out a critical examination of the indicators available in order to extrapolate to man or to low doses.

49697 **(CONF-880924—3) RASCAL [Radiological Assessment System for Consequence AnaLysis]: A screening model for estimating doses from radiological accidents.** Sjoreen, A.L.; Athey, G.F.; Sakenas, C.A.; McKenna, T.J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88008084/JAW.

From American Nuclear Society conference; Charleston, SC, USA (26 Sep 1988).

The Radiological Assessment System for Consequence AnaLysis (RASCAL) is a new MS-DOS-based dose assessment model which has been written for the US Nuclear Regulatory Commission for use during response to radiological emergencies. RASCAL is designed to provide crude estimates of the effects of an accident while the accident is in progress and only limited information is available. It has been designed to be very simple to use and to run quickly. RASCAL is unique in that it estimates the source term based on fundamental plant conditions and does not rely solely on release rate estimation (e.g., Ci/sec of I-131). Therefore, it can estimate consequences of accidents involving unmonitored pathways or projected failures. RASCAL will replace the older model, IRDAM. 6 refs.

49698 **(DOE/EH—0070) External dose-rate conversion factors for calculation of dose to the public.** (USDOE Assistant Secretary for Environment, Safety and Health, Washington, DC. Office of Environmental Guidance and Compliance). Jul 1988. 245p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88014691/JAW.

This report presents a tabulation of dose-rate conversion factors for external exposure to photons and electrons emitted by radionuclides in the environment. This report was prepared in conjunction with criteria for limiting dose equivalents to members of the public from operations of the US Department of Energy (DOE). The dose-rate conversion factors are provided for use by the DOE and its contractors in performing calculations of external dose equivalents to members of the public. The dose-rate conversion factors for external exposure to photons and electrons presented in this report are based on a methodology developed at Oak Ridge National Laboratory. However, some adjustments of the previously documented methodology have been made in obtaining the dose-rate conversion factors in this report. 42 refs., 1 fig., 4 tabs.

49699 **(DOE/EH—0071) Internal dose conversion factors for calculation of dose to the public.** (USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC). Jul 1988. 198p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88014297/JAW.

This publication contains 50-year committed dose equivalent factors, in tabular form. The document is intended to be used as the primary reference by the US Department of Energy (DOE) and its contractors for calculating radiation dose equivalents for members of the public, resulting from ingestion or inhalation of radioactive materials. Its application is intended specifically for such materials released to the environment during routine DOE operations, except in those instances where compliance with 40 CFR 61 (National Emission Standards for Hazardous Air Pollutants) requires otherwise. However, the calculated values may be equally applicable to unusual releases or to occupational exposures. The use of these committed dose equivalent tables should ensure that doses to members of the public from internal exposures are calculated in a consistent manner at all DOE facilities.

49700 **(DP-MS—88-18) Savannah River Plant emergency response capability.** Addis, R.P.; Hunter, C.H. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 7p. (CONF-880913—1). NTIS, PC A02/MF A01 - 02/MF A01; GPO Dep. Order Number DE88006111/JAW.

From ANS topical meeting on emergency response: planning, technologies and implementations; Charleston, SC, USA (26 Sep 1988).

This paper describes the Emergency Response Program at SRP, concentrating on the performance of the program for consequence assessment. Although the division between technical sup-

port and decision making is logical and appropriate for this paper, communications between technical personnel, site management, and governmental agencies are also vital. The ability to respond promptly and reliably to inadvertent releases of hazardous pollutants to the environment is vital for the safe operation of most industrial plants. Programs for taking meteorological observations at sites that may have the potential to pose a threat to the public are common. However, well coordinated programs, which integrate observations and computer predictions to provide relevant, reliable and timely information to decision makers, are less common. The Savannah River Plant (SRP) has developed a program that strives to achieve this goal by emphasizing an holistic approach to emergency response. 3 refs.

49701 **(EGG—2530) Health physics manual of good practices for uranium facilities.** Hinnefeld, S.L.; Lagerquist, C.R.; Mansfield, W.G.; Munson, L.H.; Wagner, E.R. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1988. Contract AC07-76ID01570. 479p. NTIS, PC A21/MF A01; 1; GPO Dep. Order Number DE88013620/JAW.

Historically from the health perspective, uranium has been considered more of a heavy metals than a radiological hazard. However, the revisions to biokenetic models for the evaluation of radiation exposure as contained in ICRP Publication 26 and 30 have resulted in a decrease in the annual limit of intake for uranium. This, coupled with recent changes in our understanding of the biological behavior and health significance of uranium along with technology advances for controlling, monitoring, and evaluating potential exposures of workers make it apparent that greater attention can and must be placed on controlling uranium contamination in the workplace. This manual should prove useful in providing information on design and implementation of radiation protection programs consistent with current standards and state-of-the-art technology. It is expected that this manual will serve as a guide in the evaluation of needed upgrade programs for older facilities as well as in the development of radiation protection programs for newer facilities.

49702 (INIS-BR—1147-Vol.3, pp 257-263) **Gamma radiation damage in crotamine (venom of Brazilian rattlesnake).** Costa, T.A.; Rogero, J.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Ionizing Radiations changes the molecular structure due to chemical bond destruction. These chemical alterations is able to change the biological properties of the macro-molecules. Crotamine was obtained from Crotalus durissus terrificus venom by molecular exclusion cromatography and irradiated in concentration of 2 mg/ml of NaCl 0,85% with gamma radiation produced by a /sup 60/ Co source. We used doses of 100 Gy, 250 Gy, 500 Gy, 1000 Gy and 2000 Gy (dose rate = 1,19.10/sup 3/Gy/h). We performed the following experiments: presence of free SH groups, proteic concentration,SDS-PAGE and immunodifusion. Preliminary results showed an increase of the number of bands in SDS-PAGE suggesting the appearence of protein aggregates that proportional to the dose increasing. The immunodiffusion data showed no modification of the immunochemical activity against theButantan anti - sera.

49703 (INIS-BR—1147-Vol.3, pp 273-279) **Molecular exclusion chromatographic analysis in samples of the rattlesnake venom irradiated with Co-60.** Murata, Y.; Rogero, J.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Ionizing radiations are sufficiently energetic to be able of breaking chemical bonds and as result of that molecules of substances present in the irradiated solution will be chemically changed and their biological properties affected also. In this paper the effects of gamma radiation of Co-60 on the rattlesnake venom were studied. A pool of positive crotamine Crotalus durissus terrificus venom was dissolved in 0.15 M NaCl and irradiated with Co-60. Doses of 100, 250, 500, 750, 1500 and 2000 Gy were applied at the dose rate of 1190 Gy/h. With doses over 500 Gy the solutions became turbid, suggesting the presence of aggregates and structural changes of the proteins. The concentration of proteins from the filtered solution was measured by the Lowry method. One ml samples were measured at 230 nm. The partition coefficients and the areas of the three main fraction obtained were calculated.

49704 (INIS-BR—1147-Vol.3, pp 303-312) **Gamma radiation effects on crotoxin (toxin of crotalus durissus terrificus venom).** Souza Filho, J.N.; Rogero, J.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The crotoxin is a great neurotoxin found on Crotalus durissus terrificus venom. This protein was isolated using molecular exclusion cromatography with Sephadex G-75 and irradiated in a source of /sup 60/ Co GAMMA-CELL in the concentration of 2 mg/ml 0.85% NaCl with dose rate of 1.19 x 10/sup 3/ Gy/hr. The doses used were 250, 500, 1000 and 2000 Gy. It was determinated for this samples, the proteic concentration, the diffusion immunoassay using crotalic antiserum and eletrophoresis (SDS-PAGE). The results showed some changes on the irradiated toxin. Preliminary results with doses of radiation of 100, 250, 500 and 1000 Gy showed that the letal dose 50% (LD50) in mice increase greatly with the increase of radiation's dose.

49705 (INIS-BR—1147-Vol.3, pp 313-322) **Radiation effects of /sup 60/C in peritoneal cells.** Villavicencio, A.L.C.H.; Mastro, N.L. del. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

This work deals with the effect of /sup 60/Co gamma irradiation on the levels and quality of peritoneal cells of albino mice. The cells were obtained from peritoneal exudate, fixed and stained in 30% glacial acetic acid containing 0.5% cristal violet. On exudates from irradiated and control animals the qualitative analysis and the counting of different cell populations were performed one hour, three days and six days after irradiation with 9 Gy. All the cell populations from the peritoneal exudate shown a decrease 3 days after the irradiation with 9.0 Gy but the different cellular populations diminished in unlike proportions. The data reaffirm the discrepance in radiosensivity of the diverse peritoneal cell populations.

49706 (INIS-BR—1147-Vol.3, pp 295-302) **Gamma radiation effects on the proteins of 'in vitro' bovine lenses.** Bernardes, D.M.L.; Mastro, N.L. del. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The radiosensitivity of the ocular lens manifested by cataract formation has been of considerable interest in the study on the biological effects of radiations. Cataract can ben produced by different causes and also for the normal process of ageing. The aim of this work was to develop an in vitro system similar to in vivo cataract formation. It was used an aqueous soluton of bovine lenses. The lenses after surgical removal mechanical and ultrasonic disrupted. The suspension was centrifuged and the supernatant was dialyzed and irradiated with different doses of /sup 60/Co radiation. The opacification extent was measured in an spectrophotometer.

49707 **(INIS-mf—11706) Civil Defense Commission of the Federal Minister of the Interior. Proceedings.** (Strahlenschutzkommission (SSK) beim Bundesminister fuer Umwelt, Naturschutz und Reaktorsicherheit, Koeln (Germany, F.R.)). 1986. 198p. (In German). (CONF-8605343—). NTIS (US Sales Only), PC A09/MF A01; GPO Dep. Order Number DE88754588/JAW.

From 35. annual meeting of the Schutzkommission beim Bundesministerium des Innern; Freiburg im Breisgau, F.R. Germany (8 May 1986).

The proceedings volume presents the inaugural address to the 35th Meeting of the Civil Defence Commission, the welcome addresses, a survey of the 35 years of existence and work done by the Commission, and the reports on the activities of the Technical Committees I and III-VI. The twelve scientific papers read at the meeting are given in full-text. They deal with radiation injuries caused by nuclear weapon explosions or reactor accidents, and with thermal and mechanical lesions due to nuclear weapons, with the diagnosis and therapy of the injuries, and with preventive measures, particularly through application of radioprotective substances.

49708 (INIS-mf—11795) Radiobiological studies of reoxygenation in a transplantable osteosarcoma of the mouse. Hofmann, R. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 18 Nov 1983. 84p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754655/JAW.

The isogenic osteosarcoma TVC which was grown on hybrid mice C/sub 3/Hx101 was studied with respect to its behaviour with single dose experiments (healing and growth retardation) and with fractionation experiments. After attaining the proper size the tumors were irradiated either with single doses between 30 and 75 Gy or with a first dose of 18 Gy ambient followed by test doses of 30 to 55 Gy after an interval of 1, 2, 3 and 4 days. These doses were given under ambient conditions as well as under locally ischemic conditions. After an observation period of six months each animal was evaluated as either locally healed or recidivistic. The thus determined healing rates give dose-response curves for single doses and every fractionation interval as well as for ambient and also anoxic conditions. The calculated medium healing doses makes it possible to determine the hypoxic fraction. The number of hypoxic cells at the non-irradiated tumor is less than 1%, right after irradiation with 18 Gy ambient greater than 99%. On the first day the number decreases by reoxygenation to 5%. For the second day 42% were found, for the third 10%, and for the fourth 23%. During the observation period the number of hypoxic cells never again reaches the niveau it had before the irradiation. In other words, the tumor reoxygenates poorly. The reoxygenation course of the osteosarcoma TVC was compared to other experimental tumors. For comparing methods for the determination of the per cent of hypoxic cells a growth retardation experiment with single doses from 12 to 50 Gy (ambient and anoxic) was carried out. With this method it was also determined that the number of hypoxic cells was less than 1%.

49709 (INIS-mf—11808) Changes in the prostacyctin sensitivity of thrombocytes after intravaginal radium irradiation of patients with corpus carcinoma. Schneider, A. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1987. 78p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754656/JAW.

The goal of this work was to investigate, to what extent the platelet sensitivity in comparison to prostacyclin (PGI/sub 2/) should be seen as a responsible factor in the increase of the thrombosis rate. For this blood was examined from 22 patients with corpus carcinoma who had received an intravaginal Radium implant with a radiation dose of 960 mgeh to over 24 h. These patients were compared to a control group of 21 clinically healthy women. Even before the radiation therapy there was an increased aggregation rate of the thrombocytes in the carcinoma patients as well as a reduced sensitivity to PGI/sub 2/. Under irradiation there was an even greater decrease in the sensitivity of the thrombocytes to PGI/sub 2/. The aggregation speed increase statistically significantly and the number of thrombocytes decreased during the Radium irradiation. After the giving of heparin the sensitivity of the thrombocytes to PGI/sub 2/ sank strongly.

49710 (LBL—24100) Biology and Medicine Division annual report, 1987. (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract AC03-76SF00098. 114p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88014058/JAW.

Modern biology is characterized by rapid change. The development of new tools and the results derived from their application to various biological systems require significant shifts in our concepts and the strategies that are adopted to analyze and elucidate mechanisms. In parallel with exciting new scientific developments our organizational structure and programmatic emphases have altered. These changes and developments have enabled the life sciences at LBL to be better positioned to create and respond to new opportunities. The work summarized in this annual report reflects a vital multifaceted research program that is in the vanguard of the areas represented. We are committed to justifying the confidence expressed by LBL through the new mission statement and reorganizational changes designed to give greater prominence to the life sciences.

49711 (NVO—315) Analysis of operation UPSHOT-KNOTHOLE nuclear test SIMON radiological and meteorological data. Steadman, C.R. Jr. (National Oceanic and Atmospheric Administration, Las Vegas, NV (USA). Weather Service Nuclear Support Office). Jul 1988. Contract AI08-76DP00351. 150p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88014796/JAW.

The Weather Service Nuclear Support Office has constructed a fallout pattern of the 1953 SIMON nuclear event, using that radiological and meteorological data available in 1987. This report presents the techniques employed in the fallout analysis, tabulates and evaluates the radiological data, relates the deposition pattern to the meteorological situation, and points out inconsistencies and limitations. In addition, the 1987 pattern is compared with the SIMON pattern published by the US Weather Bureau in 1956. While there are many similarities, there are some substantial differences. 28 refs., 21 figs., 16 tabs.

49712 (OEFZS—4450) DNA, sister chromatid-exchanges and immunological parameters in Rn- and occupational radiation exposure. Tuschl, H.; Kovac, R.; Topaloglou, A. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Biologie). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). May 1988. 7p. (In German). (BL—725/88). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704059/JAW.

The effects of exposure to low radiation doses are discussed in connection with DNA repair synthesis, spontaneous and Mitomycin C induced SCEs and lymphocytic subsets. Both, in personnel of the thermal gallery of Boeckstein (Badgastein), occupationally exposed persons of the Austrian Research Centre Seibersdorf and persons working near Chernobyl (USSR) during April and May 1986, induced SCEs proved to be the most sensitive indicator of radiation exposure. 4 figs., 3 tabs.

49713 (PB—88-208657/XAB) Regulations for the administration and enforcement of the Radiation Control for Health and Safety Act of 1968. (Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health). Apr 1988. 102p. (FDA/CDRH—88/35). NTIS, PC A06/MF A01.

The purpose of the Act is to protect the public from unnecessary exposure to radiation from electronic products, including ionizing, nonionizing, electromagnetic, or particulate radiation, or any sonic, infrasonic, or ultrasonic wave. The regulations in the publication cover general provisions, statements of policy and interpretation, radiation protection recommendations, recordkeeping and reporting requirements for manufacturers, dealers, and distributors; notification requirements for defects or failure to comply; repurchase, repairs, or replacement of electronic products; importation of products; and performance standards for television receivers, cathode ray tubes, diagnostic x-ray equipment, radiographic equipment, fluoroscopic equipment, computer aided tomography equipment, microwave ovens, laser products, sunlamps, ultraviolet lamps, mercury lamps, and ultrasonic therapy products.

49714 (PB—88-218987/XAB) Mechanisms of plant resistance to increased solar ultraviolet-B radiation. Final report. Teramura, A.H.; Sullivan, J.H. (Maryland Univ., College Park (USA). Dept. of Botany). May 1988. 146p. NTIS, PC A07/MF A01.

Since the major conclusions of the project are being disseminated via the scientific literature, the final report consists of a compilation of 11 articles and manuscripts on the effects of ultraviolet-B radiation (UVB) on soybean growth and yield, stress interactions with UVB, and effects of UVB on seedling growth in conifers (the Pinaceae). The effects of UVB on soybeans under field and greenhouse conditions, and under water stress, drought stress and phosphorus deficiency were studied. Soybean yields, seed quality, and physiology, including seed fatty acid and sterol composition, were determined.

49715 **(PNL—6450-7) Hanford Environmental Dose Reconstruction Project: Monthly technical report.** (Pacific Northwest Lab., Richland, WA (USA)). May 1988. Contract AC06-76RL01830. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015464/JAW.

This monthly report summarizes the technical progress and project status for the Hanford Environmental Dose Reconstruction (HEDR) Project being conducted at Pacific Northwest Laboratory (PNL) under the direction of a Technical Steering Panel (TSP). The TSP is composed of experts in numerous technical fields related to this project and represents the interests of the public. The Department of Energy (DOE) funds the project and represents the interests of the federal government and the public. The organization for the project is outlined.

49716 **(PNL-SA—15996) Lifetime followup of the 1976 americium accident victim: [Final report].** Breitenstein, B.D. Jr.; Palmer, H.E. (Hanford Environmental Health Foundation, Richland, WA (USA)). May 1988. Contract AC06-65RL01837. 19p. (CONF-880514—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014073/JAW.

From Workshop on biological assessment of occupational exposure to actinides; Versailles, France (30 May 1988).

This report describes the 11 year medical course of Harold R. McCluskey, a Hanford nuclear chemical operator, who, at age 64, was involved in an accident in an americium recovery facility in August 1976. As a result of the accident, he was heavily contaminated with americium (Am-241), sustained a substantial internal deposition of this isotope, and was burned with concentrated nitric acid and injured by flying debris about the face and neck. The immediate and long-term medical care is summarized, including decontamination procedures, chelation therapy, and routine and special clinical laboratories studies. The estimates of the operator's Am-241 deposition, post accident and during the remainder of his life and the special techniques and equipment used to make the estimates, are reported. Post-accident, the total amount of Am-241 excreted in his urine and feces was 41 MBq (1.1 mCi). He died of complications of chronic coronary artery disease on August 17, 1987. 20 refs., 2 figs.

49717 **Contamination of individuals by radon daughters: a preliminary study.** Stebbings, J.H.; Dignam, J.J. (Argonne National Lab., IL (USA)). *Archives of Environmental Health;* 43: No. 2, 149-154(Mar 1988).

Body radon daughter contamination reflects relative individual respiratory exposures to radon daughters; counts can be related both to household radon levels and to lung cancer risk factors such as sex and tobacco smoking. Radon daughters were counted by gamma spectroscopy from 180 adult residents of eastern Pennsylvania. A seven-position, 35-min scan was conducted in a mobile body counter, generally during afternoon or evening hours. Track-etch detectors for household radon were distributed, and were recovered from 80% of the subjects. Over 75% of the population had environmentally enhanced radon daughter contamination. House radon levels were strongly related, as anticipated, to radon daughter contamination in the 112 subjects for whom both sets of measurements were available (p less than .001); basement measurements were as strongly related to personal contamination as were living area measurements; bedroom measurements were slightly more strongly correlated. Both sex (p less than .02) and cigarette smoking (p less than .01) significantly modified the relationships, after nonlinear adjustment for travel times. Using a logarithmic model, a given house living-area radon level was associated in females with body contamination by radon daughters 2-3 times that in males. Nonsmokers had 2-4 times higher levels of contamination than smokers. Results are for the total of internal and external contamination, these being highly correlated in preliminary experiments. Time usage and activity patterns of the subjects are believed to be important in explaining these findings, and may become important variables in radon risk assessment.

49718 **Radiation research: Volume 1.** Fielden, E.M.; Fowler, J.F.; Hendry, J.H.; Scott, D. London, England; Taylor & Francis (1987). 456p. Unlimited audience, publicly available. Taylor Francis Ltd, 4 John Street, London WC1N 2ET. Contract FG03-87ER60499.

From 8. international congress of radiation research; Edinburgh, UK (19 Jul 1987).

This document contains 156 abstracts of papers presented at the meeting. Topics included radiation chemistry, cell damage, dosimetry, UV radiation, DNA repair, radiation induced carcinogenesis, LET radiobiology, reactor accidents, radiation effects in space, and mutagenesis. (TEM)

5602 Thermal Effects

REFER ALSO TO CITATION(S) 49550

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 48118, 48618, 48707, 48850, 49497, 49525, 49544, 49559, 49604, 49650, 49651, 49685, 49701

49719 **(AD-A—193850/5/XAB) Chemical Computer Man: Chemical Agent Response Simulation (CARS). Technical report, January 1983-September 1985.** Davis, E.G.; Mioduszewski, R.J. (Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD (USA)). Mar 1988. 21p. (CRDEC-TR—88067). NTIS, PC A03/MF A01.

The Chemical Computer Man: Chemical Agent Response Simulation (CARS) is a computer model and simulation program for estimating the dynamic changes in human physiological dysfunction resulting from exposures to chemical-threat nerve agents. The newly developed CARS methodology simulates agent exposure effects on the following five indices of human physiological function: mental, vision, cardio-respiratory, visceral, and limbs. Mathematical models and the application of basic pharmacokinetic principles were incorporated into the simulation so that for each chemical exposure, the relationship between exposure dosage, absorbed dosage (agent blood plasma concentration), and level of physiological response are computed as a function of time. CARS, as a simulation tool, is designed for the users with little or no computer-related experience. The model combines maximum flexibility with a comprehensive user-friendly interactive menu-driven system. Users define an exposure problem and obtain immediate results displayed in tabular, graphical, and image formats. CARS has broad scientific and engineering applications, not only in technology for the soldier in the area of Chemical Defense, but also in minimizing animal testing in biomedical and toxicological research and the development of a modeling system for human exposure to hazardous-waste chemicals.

49720 **(CONF-8711211—Summs.) 20th German congress on industrial safety and medicine with an international exhibition for experts. Brief version of speeches.** (Bundesarbeitsgemeinschaft fuer Arbeitssicherheit (BASI), Duesseldorf (Germany, F.R.)). 1987. 152p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88770385/JAW.

From 17. international exhibition and meeting point safety and 20. German congress on industrial safety and occupational health; Duesseldorf, F.R. Germany (3 Nov 1987).

The booklet contains the brief versions of speeches held on the 20th German Congress on Industrial Safety and Industrial Medicine, on the topics of industrial safety, industrial medicine, humanisation of the working life, security techniques, safety of medical-technical equipment, dangerous substances and dangers to health. (MBC).

49721 **(DOE/ER/60192—4) Acute pulmonary effects of formaldehyde exposure in humans: Final technical report.** Kulle, T.J. (Maryland Univ., Baltimore (USA). Dept. of Medicine). 30 Jul 1987. Contract AS05-84ER60192. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014644/JAW.

Irritation of the eyes and upper respiratory tract is the predominant symptom reported in association with low-level HCHO exposure, with bronchoconstriction reported in some individuals. There has been no systematic investigation of the symptomatic and pulmonary function response to HCHO in humans over the range of concentrations found in the home and occupational setting. In a three year study of normal nonsmoking and asthmatic subjects, we observed that some individuals will experience eye and upper respiratory tract irritation at HCHO levels of 0.5 ppM and above. Inhalation of HCHO at concentrations up to 3 ppM at rest was not associated with pulmonary function decrements or increased bronchial reactivity. Asthmatic subjects engaging in moderate exercise at 3 ppM HCHO showed no group decrements in lung function; whereas, normal nonsmoking individuals engaging in heavy exercise at 3 ppM HCHO produced small decrements in lung function. Simultaneous HCHO and carbon aerosol exposure produced small, synergistic decrements in lung function. A subset of individuals was identified who display a greater than average responsiveness to HCHO.

49722 **(DOE/ER/60469—3) Metabolism and toxicity of trace metals in the marine mussel, Mytilus edulis: Progress report, July 1, 1987-June 30, 1988.** Roesijadi, G. (Maryland Univ., Solomons (USA). Chesapeake Biological Lab.). 1988. Contract FG05-86ER60469. 10p. (UMCEES/CBL—88-91). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014729/JAW.

Since trace metals such as mercury, cadmium, copper, and zinc can be released to the marine environment as a result of the operation of energy technologies, their potential effects on marine organisms need to be understood. Marine organisms have the capability to respond to metal exposure through acclimatization or adaptation to altered conditions. Mechanisms which may be involved in conferring such capabilities have also been identified. This research project is studying one of these mechanisms, i.e., low molecular weight, metal-binding proteins, in relation to metal toxicity and acclimatization/adaptation. Specific topics to be addressed include a detailed examination of the kinetics of induction of these proteins, in response to the above metals; the cellular disposition of metals in relation to induction; and metal-toxicity in relation to induction of metal-binding proteins. Through these efforts, we expect to gain a better understanding of metal-binding proteins in a commercially and ecologically important marine animals and their relationship to toxic and adaptive responses.

49723 (INIS-BR—1147-Vol.3, pp 353-359) **Treatment of cooked and storage maize grains with the insecticide /sup 14/C - malathion.** Sampaio, M.R.F.P.; Ruegg, E.F.; Viliotti, W.M.; Mello, M.H.S.H. de. (Instituto Biologico, Sao Paulo (Brazil). Centro de Radioisotopos). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The residues of the insecticide /sup 14/C-malathion was determined in cooked maize grains, after storage as raw maize up to 24 weeks under laboratory conditions. Results showed a higher concentration of /sup 14/C - malathion residues bound to the grains in cooked maize, as compared to previous experiments conducted with raw maize, where the highest concentration was found on the surface of the grains.

49724 **(PB—88-202791/XAB) Health hazard evaluation report HETA-83-297-1846, truck terminals, St. Louis, Missouri.** McConnell, R.S.; Anderson, K.E. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Nov 1987. 37p. (HETA—83-297-1846). NTIS, PC A03/MF A01.

An evaluation was made of possible exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) at trucking terminals in St. Louis, Missouri. A self-selected group of workers participated in a medical survey. A significant association was noted between symptoms of numbness in hands and feet, pins and needles in the extremities, insomnia and feelings of depression, and possible exposure to TCDD. One case of porphyria cutanea tarda and one of dermatofibrosarcoma were reported. The patient with porphyria cutanea tarda later developed a pelvic angiosarcoma. Environmental samples revealed a dioxin concentration of about 18.7 parts per billion on the rafters inside a terminal. Dioxin was present in two surface soil samples taken near an entrance gate. The authors conclude that no definite association between TCDD exposure and symptoms or medical problems can be established. The authors recommended that measures be taken to control or eliminate possible exposures at the terminals.

49725 **(PB—88-211289/XAB) Studies of ozone-induced lung-inflammation response. Final report, July 1986-January 1988.** Adams, W.C. (California Univ., Davis (USA). Dept. of Physical Education). Apr 1988. 106p. NTIS, PC A06/MF A01.

The report covers studies that attempt to link acute changes in lung function and lung inflammation. In one study, levels of inflammatory mediators (prostaglandins) are measured in the blood of 55 healthy young adult males before and after exposure to 0.20 and 0.35 ppm ozone and after reexposure within 24 hours. However, these measurements do not appear to be sensitive enough to establish an association. In another study, the effects of 2-hour exposures of miniature swine to 0.50 ppm ozone are measured. No changes in breathing pattern, lung compliance, or prostaglandin levels in bronchoalveolar lavage fluid were found.

49726 **(PB—88-211891/XAB) Changes in pulmonary function and airway reactivity due to prolonged exposure to typical ambient ozone (O_3) levels.** Horstman, D.; McConnell, W.; Folinsbee, L.; Abdul-Salaam, S.; Ives, P. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). May 1988. 11p. (EPA—600/D-88/103). NTIS, PC A03/MF A01.

Daily ambient ozone levels between 0.08 and 0.12 ppm for periods exceeding 6 hours often occur in many urban, suburban, and rural areas of the United States and Europe. Substantial decrements in pulmonary functions, moderate to severe respiratory symptoms, and increased airway reactivity have been observed in young men performing moderate to heavy exercise. This study evaluates pulmonary responses of 22 healthy nonsmoking males, resulting from exposures to 0.08, 0.10, and 0.12 ppm ozone.

49727 **(PB—88-213202/XAB) Inflammatory response in human lung exposed to ambient levels of ozone.** Koren, H.S.; Devlin, R.B.; Graham, D.E.; McDonnell, W.F.; Mann, R. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). May 1988. 12p. (EPA—600/D-88/102). NTIS, PC A03/MF A01.

Although ozone (O_3) has been shown to induce inflammation in the lungs of animals, very little is known about its inflammatory effects on humans. In the study, eleven healthy non-smoking males, ages 18-35 were exposed once to 0.4 ppm O_3 and once to filtered air for two hours with intermittent exercise. Preliminary results from a study addressing the effect of extended O_3 exposure (7 hours, 0.1 ppm) indicated an inflammatory response in the lower airway evidenced by a 4.8-fold increase in the percent of PMN in the BAL. The findings show that an acute exposure to 0.4 ppm O_3 as well as an extended exposure result in increased levels of inflammatory cells potentially capable of producing damage in the lower airways of humans.

49728 **(PB—88-214705/XAB) Ozone-induced changes in the pulmonary clearance of (99m)Tc-DTPA in man.** Kehrl, H.R.; Vincent, L.M.; Kowalsky, R.J.; Horstman, D.H.; O'Neil, J.J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). May 1988. 13p. (EPA—600/D-88/113). NTIS, PC A03/MF A01.

Ozone is a respiratory irritant that has been shown in animals to increase the premeability of the respiratory epithelium. In

the study the authors have recently reported that respiratory epithelial permeability was similarly affected in eight healthy non-smoking young men exposed to ozone (ARRD, 135 (1987) 1124-8). Permeability was evaluated by determining the pulmonary clearance of inhaled aerosolized 99mTc-DTPA with sequential posterior lung imaging by a computer-assisted gamma camera. In a randomized crossover design, 16 young men were exposed for 2 h to purified air and 0.4 ppm ozone while performing intermittent high intensity treadmill exercise; forced vital capacity (FVC) was measured before and at the end of exposures. The results demonstrate that ozone exposure increased respiratory epithelial permeability. Such an increase may be a manifestation of direct ozone-induced epithelial-cell injury, lung inflammation, or both.

49729 **(PB—88-215629/XAB) Air-pollution effects on nasal function. Final report, June 1986-June 1987.** Tam, E.K.; Liu, J.; Bigby, B.G.; Boushey, H.A. (California Univ., San Francisco (USA). Cardiovascular Research Inst.). 8 Apr 1988. 52p. NTIS, PC A04/MF A01.

The investigators performed a series of studies to determine whether sulfur dioxide or ozone increase nasal symptoms, nasal resistance to airflow, or nasal responses to other stimuli. In the first study, it was found that sulfur dioxide did not acutely increase nasal symptoms or resistance to airflow in 12 subjects with demonstrated nasal responsiveness to instillation of antigen, or in 10 subjects with a history of nasal responsiveness to antigenic or nonantigenic stimuli. In a second study, it was found that ozone tended to cause an increase in rhinorrhea, nasal congestion and sneezing. However, this increase in symptoms was not statistically significant, was small when compared to the effects of intranasal antigen, and was not associated with a statistically significant, increase in nasal resistance. Biochemical and cellular analysis of nasal lavage fluid from 8 of these subjects did not show a consistent or striking ozone-induced change in histamine, protein, or inflammatory cells in nasal secretions. Finally, results from the third study suggest that ozone augments nasal responsiveness to antigen in at least some subjects with allergic rhinitis.

49730 **(PB—88-216999/XAB) Interaction of O_3 with salinity on vegetation. Final report, June 1985-January 1987.** Olszyk, D.M. (California Univ., Riverside (USA). Statewide Air Pollution Research Center). Mar 1987. 59p. NTIS, PC A04/MF A01.

The interaction between photochemical oxidants (primarily O_3) and salinity on vegetation was evaluated in the field. Two alfalfa cultivars, U.S. Salton and Moapa were grown at three salinity levels in soil plots. Plants were exposed to open-top chambers to filtered or unfiltered air at ambient O_3 concentrations continuously from July through mid-November 1985. Net photosynthesis, stomatal conductance, water potential, and tissue elemental content, were measured. O_3 had little effect itself on growth, yield, or physiology; only on leaf injury as measured as percent empty nodes. Salinity was much more detrimental than O_3 in affecting plants. Overall the study indicated that the salinity can reduce O_3 injury to plants, but that there was little interaction between O_3 and salinity on plant growth, yield or physiology. At the levels tested, salinity would affect plants much more than O_3 in areas where both stresses occur.

49731 **(PB—88-218474/XAB) Synthesis and biological activity of cyclopenta epoxides of PAH (polycyclic aromatic hydrocarbons) containing peripherally fused cyclopentn rings.** Bartczak, A.W.; Sangaiah, R.; Ball, L.M.; Gold, A. (North Carolina Univ., Chapel Hill (USA). School of Public Health). 1985. 15p. NTIS, PC A03/MF A01.

Pub. in Polynuclear Aromatic Hydrocarbons: International Symposium on a Decade of Progress (10th), 71-82(1985).

Polycyclic aromatic hydrocarbons (PAH) containing peripherally fused cyclopenta rings have been identified in soots from many different combustion sources. Metabolism and mutagenicity studies have been reported on the series of four cyclopenta-fused isomers derived from benzanthracene. On the basis of metabolite profiles and S9 concentration dependence of bacterial mutagenicity, it has been suggested that Aroclor 1254-induced rat liver S9 activates benz(e)aceanthrylene, benz(j)aceanthrylene, and benz(l)aceanthrylene predominantly via epoxidation of the cyclopenta ring, while other routes must be involved in the case of benz(k)acephenanthrylene. To test these conclusions, the cyclopenta epoxides of all four isomers of the cyclopenta benzanthracene derivatives were synthesized and their biological activity evaluated in the Ames assay.

49732 **(PB—88-218789/XAB) Health and environmental effects profile for Carbazole.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Apr 1986. 68p. (EPA—600/X-86/334). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for Carbazole was prepared for the Office of Solid Waste and Emergency Response to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Quantitative estimates have been presented provided sufficient data are available. Carbazole has been evaluated as a carcinogen. The human carcinogen potency factor (q1*) for carbazole is .028/(mg/kg/day)-1 for oral exposure. The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. Existing data are insufficient to determine an RQ value.

49733 **(PB—88-218961/XAB) Health and environmental effects profile for dinitrotoluene.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jun 1986. 191p. (EPA—600/X-86/159). NTIS, PC A09/MF A01.

The Health and Environmental Effects Profile for Dinitrotoluene was prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life, and environmental effects of hazardous-waste constituents. Quantitative estimates are presented provided sufficient data are available. Dinitrotolene has been evaluated as a carcinogen. The human carcinogen potency factors (q1*) for 2,4-, 2,6- and technical dinitrotoluene was .68, .23, and .23 (mg/kg/day)-1, respectively, for oral exposure. The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. The RQ value for 2.4-, 2.6- and technical dinitrotoluene is 100. Existing data are insufficient to determine an RQ value for 2.3-, 2.5- and 3.4-dinitrotoluene.

49734 **(PB—88-219357/XAB) Health and Environmental Effects Profile for brominated dibenzo-p-dioxins and dibenzofurans.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Sep 1986. 135p. (EPA—600/X-86/301). NTIS, PC A07/MF A01.

The Health and Environmental Effects Profile for Brominated Dibenzo-p-dioxins and Dibenzofurans was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life and environmental effects of hazardous-waste constituents. Quantitative estimates are presented provided sufficient data are available. Existing data are insufficient to determine a Reference Dose (RfD) or a carcinogenic potency factor for brominated diben-p- dioxins and dibenzofurans. The Reportable Quan-

tity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. Existing data are insufficient to determine an RQ value.

49735 **(PB—88-219373/XAB) Health and Environmental Effects Profile for benzotrichloride.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jul 1986. 73p. (EPA—600/X-86/194). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for benzotrichloride was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life and environmental effects of hazardous waste constituents. Quantitative estimates are presented provided sufficient data are available. Benzotrichloride has been evaluated as a carcinogen. The human carcinogen potency factor for benzotrichloride is 12.63 (mg/kg/day) for oral exposure. The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. The RQ value for benzotrichloride is 10.

49736 **(PB—88-219399/XAB) Health and environmental effects profile for allyl chloride.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jul 1986. 105p. (EPA—600/X-86/198). NTIS, PC A06/MF A01.

The Health and Environmental Effects Profile for allyl chloride was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life, and environmental effects of hazardous-waste constituents. Quantitative estimates are presented provided sufficient data are available. Allyl chloride has been evaluated as a carcinogen. The human carcinogen potency factor (q1*) for allyl chloride is 0.0206 for oral exposure. The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. The RQ value for allyl chloride is 100.

49737 **(PB—88-219431/XAB) Health and Environmental Effects Profile for benzidine.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jun 1986. 137p. (EPA—600/X-86/157). NTIS, PC A07/MF A01.

The Health and Environmental Effects Profile for benzidine was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Enviromental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life, and environmental effects of hazardous-waste constituents. Quantitative estimates are presented provided sufficient data are available. Benzidine has been evaluated as a carcinogen. The human carcinogen potency factor (q1*) for benzidine is 234.13 (mg/kg/day) for oral exposure. The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. The RQ value for benzidine 100.

49738 **(PB—88-219449/XAB) Health and environmental effects profile for benzyl chloride.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jun 1986. 103p. (EPA—600/X-86/148). NTIS, PC A06/MF A01.

The Health and Environmental Effects Profile for Benzyl Chloride was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life and environmental effects of hazardous-waste constituents. Quantitative estimates are presented provided sufficient data are available. Benzyl chloride has been evaluated as a carcinogen. The human carcinogen potency factor for benzyl chloride is 0.0171 (mg/kg/day) for oral exposure. The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. The RQ value for benzyl chloride is 1000.

49739 **(PB—88-219662/XAB) Health and Environmental Effects Profile for n,n-dimethylformamide.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). May 1986. 115p. (EPA—600/X-86/141). NTIS, PC A06/MF A01.

The Health and Environmental Effects Profile for N,N-Dimethylformamide was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health aquatic life and environmental effects of hazardous-waste constituents. Quantitative estimates have been presented provided sufficient data are available. N,N-Dimethylformamide has been determined to be a systemic toxicant. An Acceptable Daily Intake (ADI), defined as the amount of a chemical to which humans can be exposed on a daily basis over an extended period of time (usually a lifetime) without suffering a deleterious effect, for N,N-dimethylformamide is 0.096 mg/kg/day for oral exposure. The Reportable Quantity (RQ) value for N,N-dimethylformamide is 100.

49740 **(PB—88-219688/XAB) Health and Environmental Effects Profile for carbon disulfide.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jun 1986. 129p. (EPA—600/X-86/155). NTIS, PC A07/MF A01.

The Health and Environmental Effects Profile for carbon disulfide was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life, and environmental effects of hazardous waste constituents. Quantitative estimates are presented provided sufficient data are available. Carbon disulfide has been determined to be a systemic toxicant. An Acceptable Daily Intake (ADI) for carbon disulfide is 0.1 mg/kg/day for oral exposure. The Reportable Quantity (RQ) value for carbon disulfide is 1000.

49741 **(PB—88-219696/XAB) Health and environmental effects profile for chloranil.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Mar 1986. 59p. (EPA—600/X-86/083). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for Chloranil was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Quantitative estimates are presented provided sufficient data are available. Chloranil has been evaluated as a carcinogen. The human carcinogen potency factor for chloranil is 0.0403 (mg/kg/day) for oral exposure. The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. The RQ value for chloranil is 1000.

49742 **(PB—88-220348/XAB) Health and Environmental Effects Profile for chloroacetaldehyde.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jun 1986. 53p. (EPA—600/X-86/151). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for Chloroacetaldehyde was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Quantitative estimates are presented provided sufficient data are available. Chloroacetaldehyde has been determined to be a systemic toxicant. An Acceptable Daily Intake (ADI), defined as the amount of a chemical to which humans can be exposed on a daily basis over an extended period of time (usually a lifetime) without suffering a deleterious effect, for chloroacetaldehyde is 0.007 mg/kg/day for oral exposure. The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. Existing data are insufficient to determine an RQ value.

49743 **(PB—88-220363/XAB) Carcinogen risk assessment of chromium compounds.** Gibb, H.J.; Chen, C.W.; Hiremath, C.B. (Environmental Protection Agency, Washington, DC (USA). Carcinogen Assessment Group). Jun 1988. 50p. (EPA—600/D-88/129). NTIS, PC A03/MF A01.

Hexavalent chromium has been identified as a human carcinogen. Evidence to support this contention derives from epidemiologic, animal, and genotoxicity studies. Although workers exposed to both trivalent and hexavalent chromium have been shown to be at an excess risk of respiratory cancer, only hexavalent chromium has been shown to be carcinogenic in animals. Both hexavalent and trivalent chromium have been shown to be mutagenic, but the evidence for hexavalent chromium is somewhat stronger than that for trivalent chromium. The quantitative estimation of the cancer risk due to hexavalent chromium in the ambient air is calculated on the basis of lung-cancer mortality data for chromate production workers. The lifetime respiratory cancer risk due to 1 microgram/cu m) of hexavalent chromium in the ambient air is estimated to be 1.2 x .002 on the basis of Mancuso's data and 9.4 x .003 on the basis of the Braver et al. data.

49744 **(PB—88-220371/XAB) Summary of the issues with regard to the carcinogenicity, mutagenicity, and exposure of polycyclic organic matter (POM).** (Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment). Apr 1984. 286p. (EPA—600/8-88/076). NTIS, PC A13/MF A01.

Polycyclic organic matter (POM) is emitted from a variety of sources in the environment. Evidence of the carcinogenicity of emissions from coke production, motor vehicles (includes tire wear), asphalt roofing, paving, and air blowing, catalytic cracking residential coal combustion, industrial/utility coal combustion, carbon black, and iron and steel processes is presented. The contribution of the POM fraction to the carcinogenicity of the mixture is evaluated for gasoline engine exhaust condensate and coal combustion effluent and appears to contribute the majority of the carcinogenic potential for those mixtures. Evidence of the mutagenicity of emissions from coke production, motor vehicles (including tire wear), industrial/utility coal combustion, carbon black, iron and steel processes, forest fires and open burning, residential solid fuel (wood) combustion, commercial and other incineration, commercial/industrial oil combustion, residential oil combustion, and asphalt roofing, paving, and air blowing is also presented. The problem in the use of a chemical surrogate to sample for POM-containing emissions is discussed. A discussion of the problems in evaluating the carcinogenic potential of different POM-containing mixtures is also presented.

49745 **(PB—88-220728/XAB) Health and environmental effects profile for chlorthiophos.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Apr 1986. 38p. (EPA—600/X-86/333). NTIS, PC A03/MF A01.

The Health and Environmental Effects Profile for Chlorthiophos was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Chlorthiophos has been determined to be a systemic toxicant. An Acceptable Daily Intake (ADI), for chlorthiophos is 0.8 microgram/kg/day for oral exposure. The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 500 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. Existing data are insufficient to determine an RQ value.

49746 **(PB—88-220736/XAB) Health and Environmental Effects Profile for bromophos.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Apr 1986. 84p. (EPA—600/X-86/335). NTIS, PC A05/MF A01.

The Health and Environmental Effects Profile for Bromophos was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life, and environmental effects of hazardous-waste constituents. Quantitative estimates have been presented provided sufficient data are available. Bromophos has been determined to be a systemic toxicant. An Acceptable Daily Intake (ADI), defined as the amount of a chemical to which humans can be exposed on a daily basis over an extended period of time (usually a lifetime) without suffering a deleterious effect, for bromophos is 0.005 mg/kg/day for oral exposure. The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. The RQ value for bromophos is 100.

49747 **(PB—88-220744/XAB) Health and environmental effects profile for dimethylphenols.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Sep 1986. 84p. (EPA—600/X-86/256). NTIS, PC A05/MF A01.

The Health and Environmental Effects Profile for Dimethylphenols was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Dimethylphenols has been determined to be a systemic toxicant. Reference Doses (RfD), for 2,6-dimethylphenol and 3,4-dimethylphenol are 0.042 and 0.098 mg/day, respectively, for oral exposure. The Reportable Quantity (RQ) values for 2,6-dimethylphenol and 3,4-dimethylphenol are 100 and 1000, respectively. Existing data are insufficient to determine an RQ value for 2,3-, 2,4-, 2,5- and 3,5-dimethylphenol.

49748 **(PB—88-220769/XAB) Health and Environmental Effects Profile for dinitrocresols.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jul 1986. 94p. (EPA—600/X-86/197). NTIS, PC A05/MF A01.

The Health and Environmental Effects Profile for Dinitrocresols was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Dinitrocresols has been determined to be a systemic toxicant. An Acceptable Daily Intake (ADI), defined as the amount of a chemical to which humans can be exposed on a daily basis over an extended period of time (usually a lifetime) without suffering a deleterious effect, for 4,6-dinitrocresol is 0.001 mg/kg/day for inhalation exposure. The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a release as specified by CERCLA based on chronic toxicity. The RQ value for 4,6-dinitro-o-cresol is 100. Existing data are insufficient to determine an RQ value for 2,6-dinitro-p-cresol.

49749 **Bioavailability of sediment-sorbed chlorobenzenes to larvae of the midge, Chironomus decorus.** Knezovich, J.P.; Harrison, F.L. (Lawrence Livermore National Lab., CA (USA)). *Ecotoxicology and Environmental Safety;* **15**: No. 2, 226-241(Apr 1988).

Larval stages of the midge, Chironomus decorus, were used to define the bioaccumulation of sediment-sorbed mono-, di-, tri-, and hexachlorobenzene. Larvae were exposed to high- and low-organic-content sediments that had been equilibrated with individual radiolabeled chlorobenzenes prior to testing. Equilibrium or nonequilibrium aqueous concentrations of the volatile test chemicals were flowed through sealed chambers in a sediment-water exposure system. The uptake of chlorobenzenes by midge larvae was rapid for all compounds tested, and apparent steady-state conditions were reached within 48 hr of exposure. Bioconcentration factors for the accumulation of chlorobenzenes from sediments and from interstitial and overlying waters were related to the octanol/water partition coefficients of the compounds. Because the diffusion of chlorobenzenes to overlying water during nonequilibrium flow through conditions was very slow, bioaccumulation was dependent on the concentration of the chemicals in interstitial water. These results show how benthic organisms may be able to accumulate significant levels of chlorinated aromatic compounds from ecosystems where their concentrations in the water column are relatively low.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 48908, 49484, 49713

49750 **(AD-A—193104/7/XAB) Effects of pulsed and c-w (continuous-wave) 2450-MHz radiation on transformation and chromosomes of human lymphocytes in vitro. Progress report, 1 October 1986-1 October 1987.** Davis, C.C. (Maryland Univ., College Park (USA). Dept. of Electrical Engineering). 16 Feb 1988. 47p. NTIS, PC A03/MF A01.

The main objective of this project is to determine conditions of exposure of human lymphocytes in vitro to continuous-wave or pulsed-wave 2450-MHz microwaves, which: affect the course of spontaneous or phytohemagglutin in (PHA)-induced lymphoblastoid transformation, and may induce numerical and/or structural aberrations in chromosomes of cells undergoing division following transformation. In order to provide reliable quantitative data on exposure, a system will automated dosimetry was developed, and tested for biocompatibility with lymphocyte cultures in vitro for periods of up to 120 hrs. (5 days). A method for quantitation of lymphocyte transformation based on image analysis was developed and tested. Experiments on effects of exposure on spontaneous transformation were carried out. For convenience and clarity the work performed is described under two separate headings: (1) exposure system and dosimetry, and (2) studies on lymphocyte cultures.

49751 **(AD-A—193237/5/XAB) Assessment of cochlear damage after microwave irradiation. Final report, 30 September 1985-17 February 1988.** Bohne, B.A.; Gruner, M.M.; Bassen, H.I. (Washington Univ., St. Louis, MO (USA). Dept. of Otolaryngology). 26 Feb 1988. 35p. (OTO—1-88). NTIS, PC A03/MF A01.

The objective of this project was to determine whether or not excessive exposure to microwaves results in permanent damage to the inner ear. A group of 15 chinchillas was exposed for one hour to pulsed microwaves (1250 MHz) of 20 usec duration and 0.1-Hz repetition rate and an average power of 1 Watt. The specific absorption rate of various measurement sites in the head ranged from 2-8 Wkg. The exposures were done at the WRAIR Microwave Laboratory, Washington, D.C. Seven animals were sham-exposed for one hour using the same apparatus and sedation. For the sham exposures, the microwave equipment was powered but no radiation was delivered. The cochleas from 20 control chinchillas of the same age range as the animals in the study were available for comparison purposes. The controls had spent their entire lives in sound-treated animal quarters at Washington University in St. Louis, MO. The cochleas from all animals were processed for histological evaluation as plastic-embedded flat preparations. Some animals were processed less than 24 hour after their exposures; the rest were processed after a month or more of recovery. In each cochlea, the following quantitative data were obtained: the extent and pattern of degeneration in the sensory-cell populations; the number of missing pillar cells; the extent and location of degeneration of the stria vascularis and of the myelinated nerve fibers in the osseous spiral lamina.

49752 **(AD-A—193305/0/XAB) Behavioral effects of exposure to the TEMPO high-power microwave system. Interim report, January-June 1987.** Klauenberg, B.J.; Merritt, J.H.; Erwin, D.N. (School of Aerospace Medicine, Brooks AFB, TX (USA)). Mar 1988. 20p. (USAFSAM-TR—87-35). NTIS, PC A03/MF A01.

Safety standards for exposure to radiofrequency radiation must be based upon biologic consequences of exposure to such environments. Behavioral-based measures are considered to be the most-sensitive indices of biological effects. Current safety guidelines are based upon average power density and may not be relevant to the high-peak-power, short pulse width microwave radiation produced by newly developed high peak power microwave sources. The effects of exposure to high-peak-power radiation on reflexive responding and motor function in Fischer 344/N rats were assessed by measuring startle and general activity, and disruption of ongoing performance of a rotarod task, respectively. The emitter used was the TEMPO repeat pulse axially extracted vircator. Exposure to single pulses resulted in significant startle responses. Exposure to 1 pps for 10 s produced significant alterations in baseline activity and marked disruption of performance of the rotarod task. The apparently greater effect observed in the rotarod task is discussed in relation to the greater workload that task requires. Experiments are currently being conducted to identify the limits of detection and the quality of the sensory/perceptual experience of exposure to the TEMPO radiation.

49753 **Chronic exposure to ELF fields may induce depression.** Wilson, B.W. (Pacific Northwest Lab., Richland, WA (USA)). *Bioelectromagnetics (New York);* **9**: No. 2, 195-205(1988).

Exposure to extremely-low-frequency (ELF) electric or magnetic fields has been postulated as a potentially contributing factor in depression. Epidemiologic studies have yielded positive correlations between magnetic- and/or electric-field strengths in local environments and the incidence of depression-related suicide. Chronic exposure to ELF electric or magnetic fields can disrupt normal circadian rhythms in rat pineal serotonin-N-acetyltransferase activity as well as in serotonin and melatonin concentrations. Such disruptions in the circadian rhythmicity of pineal melatonin secretion have been associated with certain depressive disorders in human beings. In the rat, ELF fields may interfere with tonic aspects of neuronal input to the pineal gland, giving rise to what may be termed functional pinealectomy. If long-term exposure to ELF fields causes pineal dysfunction in human beings as it does in the

rat, such dysfunction may contribute to the onset of depression or may exacerbate existing depressive disorders. 85 references.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 48141, 48403, 49487, 49834

49754 **(AD-A—193345/6/XAB) Chemical-Stockpile Disposal Program. Monitoring concept plan. Final report, November 1986-September 1987.** Kuryk, B.A.; Roux, R.G.; Brankowitz, W.R.; Flamm, K.J.; Owens, P.M. (Office of the Program Manager, Chemical Demilitarization, Aberdeen Proving Ground, MD (USA)). 10 Sep 1987. 67p. (SAPEO-CDE-IS—87006). NTIS, PC A04/MF A01.

See also AD-A193 346.

Monitoring concepts for all aspects of the Chemical Stockpile Disposal Program are presented. The chemical-agent monitoring standards and equipment are described, and their application to storage, handling, transport, and disposal of chemical agents and munitions is discussed. The report describes the monitoring and control of the disposal-process conditions (e.g., temperature, pressure, etc.) as a means of ensuring safe plant operations. Industrial-pollutant monitoring is also covered. Organizational monitoring and control concepts are described for all aspects of the program.

49755 **(AD-A—193346/4/XAB) Chemical-Stockpile Disposal Program. Transportation of chemical munitions at reduced temperature. Final report.** Duff, W.W.; Cutler, R.M.; Perry, J.G. (Mitre Corp., McLean, VA (USA)). Aug 1987. 66p. NTIS, PC A04/MF A01.

See also AD-A193 347.

This report was produced to study the use of reduced temperature, either in the form of freezing or refrigeration, as a method of mitigating the consequences, of a chemical weapons transportation accident. The report studies the agents GB, VX and HD. The report discusses the use of reduced temperature to mitigate: (1) accidents resulting in a detonation or fire, (2) accidents resulting in a spill, and (3) emissions from leaking munitions. It also describes concepts for reducing temperatures before a move, and maintaining reduced temperatures during a move. Cost estimates are provided for these concepts.

49756 **(AD-A—193347/2/XAB) Chemical-Stockpile Disposal Program. Emergency response concept plan. Final report, October 1986-July 1987.** Cassidy, J.K.; Long, J.F.; Tamanini, H.C. (Jacobs Engineering Group, Inc., Pasadena, CA (USA)). Jul 1987. 189p. NTIS, PC A09/MF A01.

See also AD-A193 348.

The purpose of this Emergency Response Concept Plan is to present the conceptual basis for developing emergency response programs for the Chemical Stockpile Disposal Program. It presents a plan and general guidance for U.S. Army personnel, community groups, and other involved local, state, and federal agencies agencies to follow in the subsequent development of such programs. The concepts presented are comprehensive in scope, but are not intended to represent definitive criteria for emergency-program development. Rather this plan serves to identify important issues and key components of emergency response for chemical-munitions accidents and to facilitate the interaction needed to build effective programs for public protection.

49757 **(AD-A—193348/0/XAB) Chemical-Stockpile Disposal Program. Chemical weapons movement history compilation. Historical report 1946-1986.** Brankowitz, W.R. (Office of the Program Manager, Chemical Demilitarization, Aberdeen Proving Ground, MD (USA)). 12 Jun 1987. 151p. (SAPEO-CDE-IS—87001). NTIS, PC A08/MF A01.

See also AD-A193 349.

This report was produced to study the history of past chemical-weapons-movement operations from 1946 to 1986. The history was then to be used as a source of lessons learned for planning any transportation that might be required to implement the Chemical Stockpile Disposal Program. The report candidly discusses problems encountered on past chemical-weapons-movement operations and suggests areas in which the movement of chemical weapons can be improved based on past experience. The report summarizes all movement operations from 1946 to 1986, while acknowledging that this record is incomplete for some years because not all movement records were preserved.

49758 **(AD-A—193349/8/XAB) Chemical-Stockpile Disposal Program. Community review final report. Disposal of ton containers of VX. Final report, April-October 1987.** Heiser, C.; Bundy, B.; Hudson, M.; Ormond, L.; Greenwell, G. (Concerned Citizens of Vermillion, Parke, Vigo, Fountain and Tippecanoe Counties, Clinton, IN (USA)). Oct 1987. 250p. NTIS, PC A11/MF A01.

See also AD-A193 350.

This report was produced by the concerned citizens in the area of the Newport Army Ammunition Plant (NAAP) where the Army has proposed to build an incinerator to dispose of chemical agents stored at NAAP. The report addresses areas of concern the citizens identified and makes a series of recommendations to the Army as to how the chemical agent (VX) at NAAP might be disposed of.

49759 **(AD-A—193351/4/XAB) Chemical-Stockpile Disposal Program. Chemical agent and munition disposal. Summary of the US Army's experience. Final report, July 1972-August 1987.** Flamm, K.J.; Kwan, Q.; McNulty, W.B. (Office of the Program Manager, Chemical Demilitarization, Aberdeen Proving Ground, MD (USA)). 21 Sep 1987. 471p. (SAPEO-CDE-IS—87005). NTIS, PC A20/MF A01.

See also AD-A193 352.

This report was prepared in support of the U.S. Army's Chemical Stockpile Disposal Program (CSDP) Programmatic Environmental Impact Statement, and Discuss the Army's industrial-scale chemical agent and munitions disposal experience. Since 1969, when the National Academy of Science recommended that ocean dumping be discontinued as a method of chemical agent and munition disposal, the Army has destroyed nearly 15 million pounds of chemical agents by either chemical neutralization or incineration. This experience has been incorporated into the design of the Johnston Atoll Chemical Agent Disposal System, which is being constructed on a small island in the Pacific Ocean, and the proposed CSDP disposal plants.

49760 **(AD-A—193352/2/XAB) Chemical-Stockpile Disposal Program. Risk analysis of the continued storage of chemical munitions. Final report, 3 February 1986-25 August 1987.** Barsell, A.W.; Bellis, E.A.; Bolig, C.A.; Deremer, R.K.; Everline, C.J. (General Atomics Co., San Diego, CA (USA)). Aug 1987. 338p. (GA-C—18564). NTIS, PC A15/MF A01.

See also AD-A193 353.

This document was prepared for the U.S. Army to support the Final Programmatic Environmental Impact Statement for the Chemical Stockpile Disposal Program. This report describes the results of a comprehensive probabilistic assessment of the frequency and magnitude of chemical-agent release associated with the storage of chemical munitions at eight U.S. Army installations. Both internal accident initiators (e.g., human error) and external accident initiators (e.g., earthquakes) were analyzed.

49761 **(AD-A—193353/0/XAB) Chemical-Stockpile Disposal Program. Evaluation of the draft programmatic environmental impact statement for the destruction of chemical munitions stored at the umatilla army depot and other army facilities. Final report, April-October 1987.** (Umatilla County Soil and Water Conservation District, Pendleton, OR (USA)). 30 Sep 1987. 218p. NTIS, PC A10/MF A01.

See also AD-A193 354.

This report was produced by concerned citizens in the area of the Umatilla Army Depot (UMDA) where the Army has proposed to build an incinerator to dispose of chemical agent stored at UMDA. The report addresses areas of concern which the citizens identified and makes a series of recommendations as to how the chemical agent (GB, VX and HD) at UMDA might be disposed of.

49762 **(AD-A—193354/8/XAB) Chemical-Stockpile Disposal Program. Risk analysis of the onsite disposal of chemical munitions. Final report, 12 February 1986-25 August 1987.** Barsell, A.W.; Bellis, E.A.; Bolig, C.A.; Deremer, R.K.; Everline, C.J. (General Atomics Co., San Diego, CA (USA)). Aug 1987. 781p. (GA-C—18562). NTIS, PC A99/MF E04.

See also AD-A193 355.

This document was prepared for the U.S. Army to support the Final Programmatic Environmental Impact Statement for the Chemical Stockpile Disposal Program. This report describes the results of a comprehensive probabilistic assessment of the frequency and magnitude of chemical-agent release associated with storage, handling, onsite transportation and chemical-demilitarization plant operation at eight U.S. Army installations. Both internal accident initiators (e.g., human error) and external accident initiators (e.g., earthquakes) were analyzed.

49763 **(AD-A—193355/5/XAB) Chemical-Stockpile Disposal Program. Risk analysis of the disposal of chemical munitions at regional or national sites. Final report, 3 February 1986-25 August 1987.** Barsell, A.W.; Bellis, E.A.; Bolig, C.A.; Deremer, R.K.; Everline, C.J. (General Atomics Co., San Diego, CA (USA)). Aug 1987. 1158p. (GA-C—18563). NTIS, PC A99/MF E08.

See also AD-A193 354.

This document was prepared for the U.S. Army to support the Final Programmatic Environmental Impact Statement for the Chemical Stockpile Disposal Program. This report describes the results of a comprehensive probabilistic assessment of the frequency and magnitude of chemical agent release for the storage, handling, on-site transportation, off-site transportation, and chemical-demilitarization plant operations associated with the disposal of the chemical stockpile at two regional disposal sites or at a single national disposal site. Rail transportation from seven sites, air transportation from two sites and water transportation from one site were the off-site transportation modes analyzed. Both internal accident initiators (e.g., human error, equipment malfunction) and external accident initiators (e.g., earthquakes, airplane crashes) were included in the analysis.

58 GEOSCIENCES

REFER ALSO TO CITATION(S) 49569

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 48120, 48211, 48434, 49766

49764 **(LBL—25313) Frictional stability of heterogeneous surfaces in contact.** Kemeny, J.; Cook, N.G.W. (Lawrence Berkeley Lab., CA (USA)). May 1986. Contract AC03-76SF00098. 7p. (CONF-860609—18). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014864/JAW.

From 27. U.S. symposium on rock mechanics; Tuscaloosa, AL, USA (23 Jun 1986).

Utilizing the principles of elastic-brittle fracture mechanics, stress-displacement relationships are derived for an elastic solid containing a slip plane consisting of various configurations of collinear arrays of cracks. These models take into account the heterogeneous nature of slip planes as observed in the lab and in the field, and are relevant to the behavior of rock containing faults, joints, bedding planes, and fractures. All of our models exhibit slip weakening behavior, and show regimes of both stable (aseismic) and unstable (seismic) deformation. For given configurations of cracks and applied boundary conditions, our results show explicitly the energy released through unstable crack growth. For instance, it is found that two equal length cracks growing together release more seismic energy than, say, a large crack growing into a small crack. Also, by allowing cracks to coalesce, our models show multiple stick-slip events without crack healing or other geochemical means. 21 refs., 5 figs.

49765 **(MLMGWE—051981) Hydrogeologic feasibility of ground-water source heat pumps for residential applications in the Atlantic and Maritime provinces.** (MLM Ground-Water Engineering (Canada)). May 1981. 77p. (CE—01681). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Hydrogeologic descriptions of the various water-bearing zones in the Canadian Maritime provinces form the bulk of this report. Bedrock aquifer yields are generally adequate throughout the four provinces, where secondary permeability has been developed by structural deformation, or in rare instances where primary permeability is sufficiently high. Surficial aquifer yields are more variable; but where granular materials are found with sufficient thickness and areal extent, large yields can be expected. The technical feasibility of using ground water as an energy source for heat pumps in rural residences throughout the four provinces can be determined by referring to two sets of maps, enclosed with this report in a separate pocket. The sets consist of a bedrock well yield map, a surficial yield map, and a ground-water temperature distribution map. All the maps are colour coded for ease of use. One set of maps covers Nova Scotia, New Brunswick and Prince Edward Island, while the other covers Newfoundland. All currently manufactured heat pumps requiring ground water warmer than 5/sup 0/ C can be used throughout Nova Scotia, New Brunswick and Prince Edward Island. With the exception of the northern extremities, they can also be used throughout most of Newfoundland. Feed waters must be disposed after use. For both conservational and environmental reasons, the small diameter vertical injection well disposal technique is preferable to any other. 72 refs., 3 figs., 4 tabs.

5802 Geophysics

REFER ALSO TO CITATION(S) 48091, 48144, 48271

49766 **(DOE/ER/60472—02) Remote sensing and hydrologic modeling of arid watersheds: A scale analysis: Progress report.** (Pennsylvania State Univ., University Park (USA). Environmental Resources Research Inst.). [1988]. Contract FG02-86ER60472. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014625/JAW.

The ultimate goal of this multiyear research effort is to model long-term (10^2–10^4 yrs), cut and fill cycles in arid region fluvial systems (arroyos). Historic and geologic (late Quaternary) data bases indicate that arid region fluvial systems have oscillated between periods of pronounced aggradation and degradation. This cyclic behavior has affected both water and sediment discharge from arid watersheds as well as ecosystem habitats along hillslopes and valley bottoms. One of the primary causes that has been proposed for this cyclic activity is climatic change for gradual (glacial-interglacial) and catastrophic (volcanic eruptions, el Nino) rates of climatic change on a global scale. The immediate goal of this multiyear research effort is to modify existing numeric hydrologic models (SPUR, KINEROS) which utilize as input multilayered, co-registered remotely sensed data for the prediction of surface hydrology and sediment erosion, transport and deposition in arid region watersheds. It is hypothesized that different types of co-registered, remotely sensed data including digital elevation data sets (DEDS), multispectral scanner (TM, SPOT), and thermal infrared multispectral scanner (TIMS) can be used in conjunction with limited ground truth data to predict values of input parameters for numeric watershed hydrology models and thus to compute watershed hydrologic and sedimentologic characteristics.

49767 **(DOE/FTR—8013035) [Participation in 17th international conference on mathematical geophysics, Blanes, Spain, June 20-25, 1988]: Foreign trip report.** Berryman, J.G. (Lawrence Livermore National Lab., CA (USA)). 11 Jul 1988. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013035/JAW.

The purpose of this trip was to attend the 17th International Conference on Mathematical Geophysics in Blanes, Spain, during the week of June 20-25, 1988. As an invited speaker, I spoke on the subject "New applications of Fermat's principle to seismic traveltime tomography" on the morning of June 22nd. The report in-

cludes a listing of some of the most interesting talks at this conference. Also, included in the Appendices are an itinerary, a list of persons contacted, and bibliographies of literature either obtained at the conference or referenced in one of the talks.

49768 **(UCRL—53864) Lamb's problem for a linear viscoelastic medium.** Pound, Michael J. (Lawrence Livermore National Lab., CA (USA)). Feb 1988. Contract W-7405-ENG-48. 150p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88015408/JAW.

Lamb's problem for an elastic medium is one of the fundamental theoretical problems in mathematical seismology. It has been essential to the understanding of the basic interaction of waves with surfaces, including the production of such surface effects as Rayleigh waves and head waves. All real materials, however, exhibit some dissipation, and the combined effect of dissipation and surface interactions has not been well understood, particularly in the case of transient phenomena. In this work, the distance generated in a semi-infinite linear viscoelastic medium due to an impulsive line load applied normally to the surface is investigated. Uniform asymptotic techniques based on the method of steepest descent are developed to construct the long-time solution for the half-space. It is found that the solution for long times consists primarily of a set of small amplitude "precursor" signals whose properties are determined largely by the initial elastic response of the medium, and a set of much larger amplitude smooth waves. It is these smooth waves, analogous to the viscoelastic "main" waves of one-dimensional studies, which occupy the bulk of the analysis, and some of these signals are found to exhibit some interesting and unexpected properties. The Archenbach-Chao solid (ACS) model was selected as the material model for this study primarily because of its desirable physical and mathematical properties, but the results are applicable, both qualitatively and quantitatively, to a broad class of viscoelastic materials that exhibit initial elasticity and have bounded creep function. 103 refs., 24 figs.

49769 **Chemical and textural surface features of pyroclasts from hydrovolcanic eruption sequences.** Wohletz, K.H. (Los Alamos National Lab. (US)). pp 79-97 of Clastic particles: Scanning electron microscopy and shape analysis of sedimentary and volcanic clasts. Marshall, J.R. New York, NY; Van Nostrand Reinhold Co. Inc. (1987).

The purpose of this paper is to examine the vertical textural variations observed in stratigraphic sections of ash and show how these can be related to the eruptive history of volcanic vents. Samples were systematically taken from near-vent localities in vertical sequences of ash layers. Both size distributions and petrologic (chemical) constraints are among the features used in interpretation of textural features of the ash samples. The samples studied in this report were taken from four small (less than 2 km diameter) volcanoes: Crater Elegante and Cerro Colorado in Sonora, Mexico, and Panum Crater and Obsidian Dome, California. All four are typical volcanoes formed by hydrovolcanic eruptions. Crater Elegante is a basaltic tuff ring and Cerro Colorado is a tuff cone. The California examples are rhyolitic tuff rings. All are less than 10/sup 5/ years old. The significance of selecting these four volcanoes is that their pyroclasts have been formed by explosive mixing of meteoric water with magma as it approached the surface.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 48211

49770 **(LBL—25309) Determination of rock fracture parameters from crack models for failure in compression.** Kemeny, J.M.; Cook, N.G.W. (Lawrence Berkeley Lab., CA (USA)). May 1987. Contract AC03-76SF00098. 9p. (CONF-870625—22). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014863/JAW.

From 28. U.S. symposium on rock mechanics; Tucson, AZ, USA (29 Jun 1987).

Microchemical models for axial splitting and for shear faulting are used to investigate parameters associated with rock fracture under compressive stresses. The fracture energies to create splitting fractures and shear faults are calculated using laboratory triaxial data. These energies are compared with the fracture energies for the propagation of microcracks that coalesce to form the larger scale fractures. It is found that for Westerly granite, the energies to create splitting fractures and shear faults are about three orders of magnitude greater than the energy needed to drive the tensile microcracks, due to the large amount of subsidiary crack surface area created in forming the larger scale fractures. A similar scale effect can be expected when extrapolating the laboratory results to field scale problems. 35 refs., 2 figs.

5804 Geochemistry

REFER ALSO TO CITATION(S) 48127, 49149

5805 Oceanography

49771 **(DOE/ER/60333—3) West Coast Physical Oceanography Program: [Annual technical progress report]: A short report 3.** Hickey, B.M. (Washington Univ., Seattle (USA). Dept. of Oceanography). 1987. Contract FG05-85ER60333. 126p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88013229/JAW.

The overall objective of the DOE West Coast Basin Study (CaBS) is to understand the dispersion of potential contaminants from inshore waters, where they may primarily be generated, across the shelf out to deeper waters; in particular, the role of particulate fluxes, determination of general pathways of material removal, residence times, and water column/sediment exchanges. The long-term objectives of the present contract's component of CaBS are to investigate circulation in the California basin region, including both patterns and forcing mechanisms, and particle dynamics in this region; in particular, the relative importance of horizontal advection, wave/current resuspension processes, and intermediate depth nepheloid layers, in redistributing particles, on time scales of minutes to seasons. Our particular objectives during the first three years of the program are to determine the spatial scales and driving mechanisms for flow on the shelf and slope adjacent to the SM-SP basin (i.e., the relative contributions to the fluctuating flow by tidal currents, local wind stress, remotely generated coastal trapped waves, mesos-scale eddies, and deep-ocean boundary currents, are being assessed; the spatial and temporal scales of flow in the SM-SP basin; the relationship (if any) between basin circulation (both above and below sill depths) and shelf/slope circulation; and the relationship (if any) between basin and deep-ocean circulation.

49772 **(DOE/ER/60333—4) West Coast Physical Oceanography Program: Circulation and particle fluxes in the southern California Bight: [Annual technical progress report]: A short report.** Hickey, B.M. (Washington Univ., Seattle (USA). School of Oceanography). 1988. Contract FG05-85ER60333. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013230/JAW.

Field programs consisting of 40 current meters distributed on 10-15 current meter moorings were executed during 1985 to 1988 in the Santa Monica/San Pedro shelf and basin region. The CROSS experiment was designed to investigate cross-shelf/slope/basin coherence scales and forcing mechanisms; the BASIN experiment was designed to investigate longshelf and longslope and round the basin coherence scales and forcing mechanisms; the SILL experiment was designed to ascertain the importance of water and property exchange between basins; the SHELF experiment was designed to study the spring transition period, with a special focus on circulation over the shelf. CTD surveys over the basin and shelf were taken upon deployment and retrieval of the moorings and usually on one cruise mid-way through the deployment. The CTD cruises, each with {approximately}80 stations that include transmission and oxygen data as well as temperature and conductivity, will number eight when the final six months of this grant begins. Several conclusions are possible. With few exceptions, flow the Santa Monica Basin is poleward throughout the year for monthly averages. The poleward flow occurs in long period pulses that have generally short (<20 km) coherence scales. The pulses are not driven by local wind and do not have the characteristics of coastal trapped waves. Pulses of equatorward flow can occur at times, particularly during spring in the surface layers. At this time, inflow from the

Santa Barbara Channel occurs (e.g., May 86). The average below-sill depth circulation pattern is a counterclockwise gyre, with speeds {approximately}0.5 cm s^{-1}.

64 PHYSICS I

REFER ALSO TO CITATION(S) 48714

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 49952, 50040

49773 **(AD-A—193026/2/XAB) Properties of solar-coronal active regions deduced from x-ray line spectra.** McKenzie, D.L. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 5 Feb 1988. 34p. (TR—0086A(2940-01)-1). NTIS, PC A03/MF A01.

Coronal active regions, the sites of energetic solar flares, have temperatures higher than 10 K and emit strongly in the x-ray region of the spectrum. In this report, x-ray emission line-ratio diagnostics for electron density and temperature are applied to over 100 spectra of nonflaring active regions taken by the SOLEX B spectrometer aboard the U.S. Department of Defense Space Test Program's P78-1 Satellite from March to November 1979. The purpose is to draw general conclusions from analysis of the spectra of a large variety of regions. In the course of the study, the author was also able to evaluate existing theoretical calculations of the helium-like-ion line ratios. A number of them can now be rejected as inconsistent with the data. Future work may modify the conclusions of the study, but not significantly.

49774 **(AD-A—193291/2/XAB) Measurement of macroscopic electric fields in solar-plasma structures. Final technical report, 27 May-27 November 1987.** Foukal, P. (Cambridge Research and Instrumentation, Inc., MA (USA)). 14 Dec 1987. 32p. NTIS, PC A03/MF A01.

The work performed in this effort led to several important advances in investigation of a new technique for remote sensing of plasma electric fields. The atomic physics underlying the technique is placed on a firmer basis and the polarization structure of the high Balmer and Paschen lines behaves as predicted by perturbation theory. Balmer- and Paschen-line observations of erupting prominences are obtained at Sacramento Peak Observatory and show that the marked increase in sensitivity of the technique expected with the Paschen lines can be realized. Understanding of the interpretation of the observed hydrogen-line broadening is improved, and shown that the sensitivity of the technique, when applied to structures emitting intense hydrogen lines, can exceed 10 volts/cm. This sensitivity is more than adequate to test predictions of transverse electric fields intensities and orientations, in models of flares and other active phenomena. The goal is to construct an instrument optimized for solar plasma electric field measurements, to be installed at the SPO Big Dome. Such an electrograph would make important advances toward understanding the mechanisms and prediction of solar eruptions such as flares and active filaments.

49775 **(AD-A—193396/9/XAB) Solar flares and magnetospheric particles: investigations based upon the ONR-602 and ONR-604 experiments. Annual letter report for period ending 30 November 1987.** Wefel, J.P. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). 10 Feb 1988. 22p. NTIS, PC A03/MF A01.

Data from the ONR-602 experiment, obtained in a low-altitude polar orbit, are being analyzed to investigate the composition, intensity levels, and time variations of energetic charged particles both trapped within the Earth's magnetosphere and incident upon the magnetosphere from interplanetary space, particularly solar-flare particles. The effort involves both data analysis/interpretation and detailed modeling of the near-Earth environment. The research focusses on the global zones of low-energy-particle precipitation, including the South Atlantic Anomaly region from which access to the radiation belts is obtained, and the solar particle events of May-Nov., 1982. In addition, scientific/technical support is being provided to the ONR-604 experiment to be launched on the CRRES mission. The results of these investigations will enhance our understanding of the geospace radiation environment and its effects on men, materials, and electronic systems in space. The objectives of this research are to investigate the nature and origins of the particle populations in near Earth space by focusing on their spatial distributions, composition, energy spectra, and temporal variations and to look at couplings between interplanetary (solar-flare-generated) and magnetospheric populations. The goal is to understand the geospace environment in which men and spacecraft must survive and function.

49776 **(AD-A—193810/9/XAB) Small-scale motions over concentrated magnetic regions of the quiet Sun.** Dara, H.C.; Alissandrakis, C.E.; Koutchmy, S. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1987. 12p. (AFGL-TR—88-0083). NTIS, PC A03/MF A01.

Pub. in Solar Physics, Vol. 109, 19-29(1987).

A 5.5-min time sequence of spectra in the Fe lines lambda(5576)(magnetically insensitive), lambda(6301.5), and lambda(6302.5)(magnetically sensitive) is used to study the association of concentrated magnetic regions and velocity in the quiet Sun. After the elimination of photospheric oscillations, downflows of 100-300 m/s were found, displaced by about 2 seconds from the peaks of the magnetic field; this velocity is comparable to downflow velocity associated with the granulation and of the same order or smaller than the oscillation amplitude. Quasi-periodic time variations of the vertical component of the magnetic field up to + or - 40% were also found with a period near 250s, close to the values found for the velocity field. Finally, the authors report a possible association of intensity maxima at the line center with peaks of the oscillation amplitude.

49777 **(AD-A—193816/6/XAB) Impulsive phase transport. Chapter 3.** Canfield, R.C.; Bely-Dubau, F.; Brown, J.C.; Dulk, G.A.; Emslie, A.G. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 30 Mar 1988. 51p. (AFGL-TR—88-0087). NTIS, PC A04/MF A01.

Presented at Solar Maximum Mission Flare Workshop Proceedings, Greenbelt. MD 24-28 Jan 83, 9-14 Jun 83, 13-17 Feb 84.

The collective body of evidence derived from hard x-ray, gamma-ray, ultraviolet, microwave, and visible-light observations of the impulsive phase of solar flares is reviewed and reexamined within the context of models for energy release and energy transport. Strong support is found for energy transport by nonthermal electrons accelerated in the solar corona. These electrons can be shown to be adequate in providing energy to the hard x-ray and microwave bursts, but they have difficulty in explaining the optical emission originating from the deep chromosphere; in addition, gamma-ray bursts seem to require high-energy protons. It is concluded that our understanding of the impulsive phase is less than satisfactory.

49778 **(AD-A—193882/8/XAB) Eclipses of the sun.** Koutchmy, S. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1987. 29p. (AFGL-TR—88-0088). NTIS, PC A03/MF A01.

Pub. in Astronomie le Guide de L'Observateur, Vol. 1, 93-117(1987).

A study is presented on solar eclipses, how they are formed, and what can be learned from them.

49779 **(AD-A—193883/6/XAB) Solar-granulation power spectra from speckle interferometry.** Von Der Luehe, O.; Dunn, R.B. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1987. 14p. (AFGL-TR—88-0082). NTIS, PC A03/MF A01.

Pub. in Astronomy and Astrophysics, Vol. 177, 265-276(1987).

Granulation was observed with a CCD array at the SPO tower telescope in a quiet region near the solar center. The authors took time series of short-exposure (4 ms) pictures of a 14 sec by 14 sec region. Consecutive frames were separated by 0.55s in time. They applied Labeyrie's (1970) speckle-interferometry technique in order to recover power spectra of the intensity fluctuations at high spatial frequencies. The spectral-ratio technique was applied to correct for seeing attenuation of the power spectra. Signal up to a spatial frequency of 2.5 line pair per arcsecond was recovered, corre-

sponding to a wave number of 22 M/m or 40% of the diffraction limit of the telescope under 1.3 arcsec average seeing conditions. A corrected rms granulation contrast of 0.127 + or - 0.01 was estimated, and an exponential falloff was observed of power density towards higher spatial frequencies.

49780 (AD-A—193884/4/XAB) Turbulence as a contributor to intermediate energy storage during solar flares. Bornmann, P.L. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1 Feb 1987. 8p. (AFGL-TR—88-0081). NTIS, PC A02/MF A01.

Pub. in Astrophysical Jnl., Vol. 313, 449-455(1 Feb 87).

Turbulence is considered as a method for converting the energy observed as mass motions during the impulsive phase into thermal energy observed during the gradual phase of solar flares. The kinetic energy of the large-scale eddies driven by the upflowing material continuously cascades to smaller-scale eddies until viscosity is able to convert it into thermal energy. The general properties of steady-state, homogeneous, fluid turbulence in a nonmagnetic plasma and the properties of turbulent decay are reviewed. The time-dependent behavior of the velocities and energies observed by the X-ray Polychromator (XRP) instrument on Solar Maximum Mission (SMM) during the 1980 November 5 flare are compared with the properties of turbulence. This study indicates that turbulence may play a role in flare energetics and may account for a fraction of the total amount of thermal energy observed during the gradual phase. The rate at which the observed flare velocities decrease is consistent with the decay of turbulent energy but may too rapid to account for the entire time delay between the impulsive and gradual phases.

49781 (AD-A—193885/1/XAB) Solar-stellar connection at low spectral resolution. Radick, R.R. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). Sep 1986. 4p. (AFGL-TR—88-0076). NTIS, PC A02/MF A01.

Pub. in SHIRSOG Workshop, 133-135(Sep 1986).

Observations at low spectral resolution (i.e., less than a few thousand) have played an important role in the development of the subdiscipline called the solar-stellar connection. However, the author does not intend to provide a comprehensive review, either of that history, or of current work being done at low resolution. Rather, the author presents briefly some examples of recent results, primarily from a photometric program at Lowell Observatory, but also from the H-K spectrophotometric program at Mount Wilson, in order to illustrate what is currently being done in this area. He then outlines a concept for a new approach aimed at studying the rotation and activity of very large samples of stars.

49782 (AD-A—193922/2/XAB) Vertical motions in quiescent prominences observed in the He i lambda 10830A line. Engvold, O.; Keil, S.L. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1986. 8p. (AFGL-TR—88-0078). NTIS, PC A02/MF A01.

Pub. in Coronal and Prominence Plasmas 169-175(1986).

Movies of quiescent prominences seen in H/sub A/ show apparent downflow of matter. The effect is confirmed by observations of downflows in the Ca II K line from large filaments/prominences. Several recent studies show evidence for the opposite case from observations in H/sub A/, i.e., that there is a predominantly upward directed flow in prominences seen on the disk. The quoted results are slightly ambiguous because the observed Ca II K and H/sub A/ line shifts can be severely influenced by displacements of the chromospheric component of the line and by the line opacity and source function which generally are not well known. This problem is discussed in connection with measurements of chromospheric velocities. Velocity fields in solar prominences are discussed.

49783 (AD-A—193923/0/XAB) Line asymmetries and shifts in the presence of granulation and oscillations: the clv of the Ki 7699 resonance line. Marmolino, C.; Roberti, G.; Severino, G. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1987. 14p. (AFGL-TR—88-0079). NTIS, PC A03/MF A01.

Pub. in Solar Physics, Vol. 108, 21-33(1987).

The effects are studied of both the solar granulation and short-period oscillations on the solar profile of the Ki 7699 resonance line and its center-to-limb variations. The granular model used is from Nelson (1978). The wave field is obtained by adding two 30-s acoustic waves with opposite horizontal wave numbers to allow for the center-to-limb calculations. The broadening and strengthening produced by the dynamical models do not fill the gap existing between the observations and the values computed in a static atmosphere. Then, either the granular model has to be revised (in particular its r.m.s. velocities are too low) or other types of motions, like gravity waves, have to be accounted for. The upper part of the mean bisectors is affected by granulation and the lower part by waves. With some qualification concerning the data used for comparison, a satisfactory fit of the observed center-to-limb variations of the mean bisectors is obtained when both dynamical models are included and the granular velocities are increased by a factor 1.5.

49784 (AD-A—193926/3/XAB) Dynamic flare with anomalously dense flare loops. Svestka, Z.; Fontenla, J.M.; Machado, M.E.; Martin, S.F.; Neidig, D.F. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1986. 5p. (AFGL-TR—88-0077). NTIS, PC A02/MF A01.

Pub. in Advances in Space Research, Vol. 6, No. 6, 253-256(1986).

The dynamic flare of 6 November 1980 (max. approx 15:26 UT) developed a rich system of growing loops which could be followed in H α for 1.5 hours. Throughout the flare, these loops, near the limb, were seen in emission against the disk. Theoretical computations of b-values for a hydrogen atom reveal that this requires electron densities in the loops to be close to 10^{12}/cc. From measured widths of higher Balmer lines, the density at the tops of the loops was found to be 4 x 10^{12}/cc if no nonthermal motions were present. It is now general knowledge that flare loops are initially observed in x rays and become visible in H α only after cooling. For such a high density a loop would cool through radiation from 10^7 power K to 10,000 K within a few minutes so that the dense H α loops should have heights very close to the heights of the x-ray loops. This, however, contradicts the observations obtained by the HXIS and FCS instruments on board SMM which show the x-ray loops at much higher altitudes than the loops in H α. Therefore, the density must have been significantly smaller when the loops were formed and the flare loops were apparently both shrinking and becoming denser while cooling.

49785 (DOE/ER/40317—2) Research in nuclear astrophysics: stellar collapse and supernovae: Annual performance report, December 1, 1987--November 30, 1988. Lattimer, J.M.; Yahil, A. (State Univ. of New York, Stony Brook (USA). Dept. of Earth and Space Sciences). 1988. Contract FG02-87ER40317. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015267/JAW.

This annual performance report summarizes the activity in the nuclear astrophysics research program in the Earth and Space Scienes Department at Stony Brook. The central themes in the projects that comprise this program are supernovae, neutron star formation, and the equation of state of hot, dense metter. There is a close coupling between the physics of nuclear matter and weak interactions on the one hand, and supernovae and neutron stars on the other. The properties of nuclear matter might at present best be delineated by astrophysical considerations. We have been active in researching both the nuclear physics of the equation of state and the astrophysics of stellar collapse, neutrino emission, and neutron star formation. 11 refs.

49786 (LA-UR—88-2222) Study of a substorm on May 4, 1986. Hones, E.W.; Craven, J.D.; Frank, L.A.; Galvin, A.B.; Murphree, J.S.; Elphinstone, R.D.; Elphic, R.C. (Los Alamos National Lab., NM (USA); Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy; Maryland Univ., College Park (USA). Inst. for Physical Science and Technology; Calgary Univ., Alberta (Canada). Dept. of Physics; California Univ., Los Angeles (USA). Inst. of Geophysics and Planetary Physics). 1988. Contract W-7405-ENG-36. 16p. (CONF-880780—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014318/JAW.

From 27. plenary meeting of COSPAR; Espoo, Finland (18 Jul 1988).

A substorm on May 4, 1986, midway through the PROMIS campaign of coordinated data acquisition, was uniquely well documented. Both in its aspects at earth and in its magnetotail aspects. The expansive phase onset was imaged by the Viking satellite at 20-second time resolution. Most of the expansive phase was also imaged by DE 1 at 6-minute time resolution. ISEE 1 and 2 were near the tail's axis 18.5 R/sub e/ from earth operating at high data rate and data were recorded by several geosynchronous satellites. This multi-satellite study provides evidence that the active substorm aurora occurs at the feet of field lines that map to a magnetic X-line in the near tail. The longitudinal extension of the aurora during a substorm is associated with cross-rail lengthening of the near-earth neutral line. The concept of the "poleward leap" of the auroral electrojet (and the auroras) as the culminating feature of the expansive phase finds further support in these data. 7 refs., 6 figs.

49787 (LA-UR—88-2403) The history of gamma-ray burst observations. Klebesadel, R.W. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 24p. (CONF-880297—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014390/JAW.

From International symposium on the physics of neutron stars and black holes; Tokyo, Japan (1 Feb 1988).

Cosmic gamma-ray bursts have been observed for 1-1/2 decades since their fortuitous discovery by nuclear test detection instruments flown on the Vela satellites. Although the volume and detail of data available through these observations has considerably refined our knowledge of the characteristics of these events, there is no confident identification of source objects or reliable model of the processes involved. The observations do suggest, however, that the bursts originate at neutron stars (probably highly-magnetized neutron stars). 17 refs., 16 figs.

49788 (PB—88-209549/XAB) Existence of stationary solutions in the coronal loop problem. Hulshof, J.; Terman, D.; Verhulst, F. (Technische Hogeschool Delft (Netherlands). Onderafdeling der Wiskunde en Informatica). 1988. 28p. (REPT—88-06). NTIS, PC E03/MF A01.

The study of a hot plasma confined to a magnetic loop in the sun's corona leads to a singularly perturbed nonlinear reaction-diffusion equation with rather unusual side conditions. Monotone solutions of the stationary problem appear as fixed points of an iteration map which is contractive if the perturbation parameter is sufficiently small.

49789 (PB—88-214846/XAB) White Light Solar Corona: An ATLAS of 1987 K-coronameter Synoptic Charts, December 1986-January 1988. Technical note. Sime, D.G.; Garcia, C.; Yasukawa, E.; Lundin, E.; Hoffman, F. (High Altitude Observatory, Boulder, CO (USA)). Mar 1988. 87p. (NCAR/TN—309-STR). NTIS, PC A05/MF A01.

The synoptic observing project of the High Altitude Observatory's Coronal Dynamics Program began on 5 August 1980. The data obtained for it are gathered by the Mark III K-coronameter located at the Mauna Loa Solar Observatory, Hawaii, and are published yearly in volumes of The White Light Solar Corona: An Atlas of K-Coronameter Synoptic Charts. The data, in the form of synoptic charts, are extended at both the beginning and the end of each year to provide some overlap with the preceding and succeeding volumes. This is also necessary to provide a complete set of the data organized into Carrington rotations covering a specific time period, since the rotations do not coincide with the yearly calendar. Further, observations are made at the limb, and west limb passage occurs 14 days after east limb passage. Thus, an entire rotation's data requires more than 28 days to collect. As well as the synoptic maps, two additional sections designed to aid the user are included in the volume. As in previous Atlases, the Activity Report Summary for the year and Polar Synoptic Charts are included. Also included the Mauna Loa Solar Observatory Calendar for 1987.

49790 (PB—88-217393/XAB) Solar-Geophysical Data Number 524, April 1988. Part 1 (prompt reports). Data for March, February 1988, and late data. Coffey, H.E.; McKinnon, J.A. (National Geophysical Data Center, Boulder, CO (USA)). Apr 1988. 135p. (SGD—524-PT-1). NTIS, PC A07/MF A01.

See also PB—88-194733 and PB—88-217401.

Contents include: detailed index for 1987 and 1988; data for March 1988--(IUWDS alert periods (advance and worldwide), solar flares, solar radio emission, Stanford mean solar magnetic field, Vostok inferred interplanetary magnetic field); data for february 1988--(solar-active regions, sudden ionospheric disturbances, solar radio spectral observations, geomagnetic indices, radio propagation indices); late data--(Pioneer XII interplanetary magnetic field -- July-September 1987, cosmic-ray measurements by neutron monitor, geomagnetic sudden commencements/solar flare effects).

49791 (PB—88-217401/XAB) Solar-Geophysical Data Number 524, April 1988. Part 2 (prompt reports). Data for October 1987, and miscellanea. Coffey, H.E.; McKinnon, J.A. (National Geophysical Data Center, Boulder, CO (USA)). Apr 1988. 54p. (SGD—524-PT-2). NTIS, PC A04/MF A01.

See also PB—88-194741 and PB—88-217393.

Contents include: data for October 1987--(Meudon carte synoptique, Solar flares, Solar radio bursts at fixed frequencies, Solar x-ray radiation from GOES satellite, Mass ejections from the sun, Active prominences and filaments).

49792 (RRK—88-4) Condition for classical slow rolling in new inflation. Sasaki, Misao; Nambu, Yasusada; Nakao, Kenichi. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Feb 1988. 13p. NTIS (US Sales Only), PC A03/MF A01; GPO Dep. Order Number DE88754573/JAW.

By means of the stochastic description of inflation, we investigate the dynamics of a fixed comoving domain in a continuously inflating universe on the global scale, both analytically and numerically. A particular attention is paid to the condition for a domain to enter the classical slow rolling phase. New inflationary universe models with the potential form, V(phi) {similar←to} V/sub 0/ - cphi/sup 2n/ at phi {similar←to} 0 are considered. The critical value of the scalar field beyond which the field slowly rolls down the potential hill is estimated. We find, for all models under consideration, the condition for classical slow rolling is a sufficient condition for the expected amplitude of density perturbations to be smaller than unity. In other words, the density perturbation amplitude at the later Friedmann stage is always smaller than unity if the universe experienced the classical slow roll-over phase.

49793 (RRK—88-8) On a quantized scalar field in Nariai's universe with the topology S tilde/sub 2/ x S/sub 2/. Nariai, Hidekazu. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Feb 1988. 10p. NTIS (US Sales Only), PC A02/MF A01; GPO Dep. Order Number DE88754576/JAW.

As a sequel to the previous note (Preprint RRK 87-24) dealing with a scalar field in Nariai's universe with the topology S tilde/sub 2/ x S/sub 2/, the scalar field in our universe is canonically quantized. Various propagators of the quantized scalar field are introduced, but the uniquely derived one is the 4-dimensional commutation function G(x, x') which satisfies the homogeneous wave equation and the condition. Its characteristic features are also discussed.

49794 (RRK—88-9) Cosmological observations in a perturbed Friedmann Universe. Kasai, Masumi. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Feb 1988. 38p. NTIS (US Sales Only), PC A03/MF A01; GPO Dep. Order Number DE88754577/JAW.

General formulas for the cosmological observables - the luminosity distance, the angular diameter distance, the parallax distance and the number count - in a linearly perturbed Friedmann Universe are derived. Their invariance under any coordinate-gauge transformations and any affine transformations is explicitly shown. Then they are applied to the Einstein-de Sitter background model in the presence of scalar perturbations and their implications are discussed.

49795 (RRK—88-10) On a quantized scalar field in some Kantowski-Sachs' universe. Narini, Hidekazu. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Mar 1988. 10p. NTIS (US Sales Only), PC A02/MF A01; GPO Dep. Order Number DE88754578/JAW.

As a sequel to the previous note (RRK 87 - 22) dealing with a scalar field in Groen's model-universe satisfying the vacuum Einstein equations R/sub $\mu\nu$/ = Λg/sub $\mu\nu$/ (Λ: the cosmological constant) with the topology of Kantowski-Sachs' type, the scalar field in the universe is canonically quantized. Various propagators of the quantized scalar field, especially the 4-dimensional commutation function G(x, x') which satisfies the homogeneous wave equation and the condition are introduced. Its characteristic features are also discussed. (J.P.N.).

49796 (UCRL—98838) The quark-hadron phase transition in the early universe. Alcock, C.R.; Fuller, G.M.; Mathews, G.J. (Lawrence Livermore National Lab., CA (USA)). 24 Jun 1988. Contract W-7405-ENG-48. 12p. (CONF-880280—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014483/JAW.

From International conference on physics and astrophysics of quark-gluon plasma; Bombay, India (8 Feb 1988).

A first order phase transition between the quark-gluon plasma and the hadron gas can have important consequences for cosmology. These consequences result from the generation of isothermal baryon number density fluctuations as the universe passes through the phase transition. Calculations based upon simple models for the statistical mechanics of the two phases indicate that these fluctuations have large amplitude. The fluctuations persist after completion of the phase transition, being slowly damped by diffusion of baryon number. Upon decoupling of neutrons and protons at temperature T {approximately} 1 MeV, the neutrons begin to diffuse rapidly out of the dense regions and substantial segregation of the neutrons and protons results. Light element nucleosynthesis then occurs at T {approximately} 0.1 MeV. It is possible to reconcile the observed abundances of the light elements with model universes in which all of the matter is composed of baryons, the cosmological constant is zero, and the geometry is flat. 12 refs., 2 figs.

49797 (UCRL—98942) Generation of fluctuations from the quark-hadron transition in the early universe. Fuller, G.M.; Mathews, G.J.; Alcock, C.R. (Lawrence Livermore National Lab., CA (USA)). 1 Jun 1988. Contract W-7405-ENG-48. 18p. (CONF-8803113—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013100/JAW.

From 8. Moriond astrophysics meeting on dark matter; Les Arcs, France (6 Mar 1988).

We present a model for the generation of isothermal baryon density fluctuations in the early universe associated with the quark-hadron transition. The model is based on thermal nucleation theory for the creation of bubbles of the new phase and on entropy conservation during the phase transition. We find that the baryon number transport characteristics together with the rapid motion of the phase boundary can result in baryon density fluctuations with amplitudes considerably larger than the chemical equilibrium limit. All of these results depend on uncertain quantities associated with the underlying QCD physics. We discuss how uncertainties in these quantities translate into uncertainties in the fluctuation amplitude, shape, and mean separation.

49798 (UCRL—98943) The evolution of baryon number density fluctuations before, during and after primordial nucleosynthesis. Mathews, G.J.; Fuller, G.M.; Alcock, C.R.; Kajino, T. (Lawrence Livermore National Lab., CA (USA)). 1 Jun 1988. Contract W-7405-ENG-48. 10p. (CONF-8803113—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013099/JAW.

From 8. Moriond astrophysics meeting on dark matter; Les Arcs, France (6 Mar 1988).

The simultaneous evolution of weak and nuclear reactions along with baryon diffusion in isothermal fluctuations produced in the quark-hadron phase transition is discussed. We find that the resulting light-element nucleosynthesis is sensitive to the separation distance between fluctuations, although still consistent with observed light-element abundances (except possibly ^{7}Li) for a reasonable range of separations between fluctuations. The heavy-element nucleosynthesis has been computed for all nuclei up to A = 28. It appears that an r-process "seed" abundance will be formed with a mass fraction of 10/sup {minus}12/ to 10/sup {minus}10/. It is not yet clear whether this will lead to an overproduction of r-process abundances relative to that observed in metal-poor halo stars. The evolution of the fluctuations after nucleosynthesis is discussed and it is concluded that these fluctuations are not likely to collapse to form compact cold-dark-matter remnants, but are probably smoothed by baryon diffusion before recombination. 17 refs., 3 figs.

49799 (UCRL—99326) Prospects for understanding the astrophysical r-process. Mathews, G.J.; Cowan, J.J. (Lawrence Livermore National Lab., CA (USA)). Jul 1988. Contract W-7405-ENG-48. 6p. (CONF-880795—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015449/JAW.

From Tokyo symposium on heavy-ion and nuclear astrophysical problems; Tokyo, Japan (19 Jul 1988).

This paper discusses several recent advances toward a deeper understanding of the still unknown astrophysical site for rapid (r-process) neutron capture nucleosynthesis. The physical constraints on the r-process from the input nuclear data are highlighted and the particular importance of the recent measurements of beta-decay lifetimes along the r-process path is discussed. Astronomical observations of s- and r-process elemental abundances on metal poor halo stars are also discussed, in the context of models for the galactic chemical evolution of heavy-element abundances, as a constraint on the nature of the r-process. On the basis of these constraints it is suggested that the most likely source for the r-process may be from the ejection of core material from low-mass type II supernovae. 27 refs., 1 fig.

49800 Solar flare protons and alpha particles during the last three solar cycles. Goswami, J.N.; McGuire, R.E.; Reedy, R.C.; Lal, D.; Jha, R. (Physical Research Laboratory, Ahmedabad, India). *Journal of Geophysical Research;* 93: No. A7, 7195-7205(1 Jul 1988).

Event-integrated fluxes of protons and alpha particles in solar-flare-associated particle events during solar cycle 21 (1976—1986) are determined from data obtained by detectors on board the IMP-7 and IMP-8 satellites. Sixty-three solar particle events with proton fluence (E>10 MeV)>10^7 cm^{-2} were identified from October 1972 to March 1987. The average omnidirectional flux of protons with kinetic energy>10 MeV for cycle 21, 64 cm^{-2} s^{-1}, is lower than the corresponding number for cycle 20 (92 cm^{-2} s^{-1}) based on satellite data and for the cycle 19 (378 cm^{-2} s^{-1}) based on lunar sample data. Six large events contributed 70% of the total proton fluence during solar cycle 21. Several events in early 1981 with high proton fluences could account for much of the high ^{56}Co radioactivities observed in the small-sized Salem meteorite. The event-averaged alpha-particle to proton ratio in the energy interval 1—10 MeV/nucleon varies from 0.006 to 0.05, with an average value of 0.02 for the whole cycle. The events during solar cycle 21 are characterized by softer spectra for both protons and alpha particles compared to those in earlier solar cycles. No definitive correlation exists between cycle-averaged solar flare proton fluxes and peak sunspot numbers. A comparison with long-term (million year) averaged data for these parameters, obtained from lunar sample data, shows that the contemporary solar flare proton spectra are characterized by softer spectra (lower R_o values). A similar comparison cannot be made for the mean long-term averaged flux, as the contemporary average suffers from uncertainty due to statistics of single events.

49801 Test particle model of pickup ions at comet Halley. Luhmann, J.G.; Fedder, J.A.; Winske, D. (Institute of Geophysics and Planetary Physics, University of California, Los Angeles). *Journal of Geophysical Research;* 93: No. A7, 7532-7537(1 Jul 1988).

A test particle treatment is used to investigate some of the details of the pickup cometary ions observed at comet Halley. The effects of the large-scale magnetic and motional electric fields, as described by an MHD model of the comet, produce the characteristic V shape seen in Giotto observations in simulated energy-time

spectrograms. It is demonstrated that scattering produced by the addition of magnetic field fluctuations can obscure the tendency of the large-scale field to deflect energetic ions picked up in the outer coma from the tail axis. The fact that the V is so clearly observed in the Giotto spectrogram thus suggests that although scattering must be invoked to explain the isotropic pitch angle distributions and highest energy ions, it does not have a major effect on the overall pickup ion spectrum. copyright American Geophysical Union 1988

49802 **Radio astronomy on the moon.** Burns, J.O.; Asbell, J. pp 29-39 of Radio astronomy from space; Proceedings of the Workshop, Green Bank, WV, Sept. 30-Oct. 2, 1986. Weiler, K.W. Charlottsville, VA; National Radio Astronomy Observatory (1987). (CONF-8609394—).

From NRAO workshop on cometary radio astronomy; Green Bank, WV, USA (24 Sep 1986).

The advantages and opportunities for radio astronomy on the moon during the early to mid 21st century are reviewed. In particular, it is argued that the lack of atmosphere, the extremely low seismic activity, the low RF background, and the natural cryogenic environment make the moon (particularly the far side and the poles) a nearly ideal locale for submillimeter/FIR to VLF (below 10 MHz) radio astronomy. 22 references.

6402 Atmospheric Physics

REFER ALSO TO CITATION(S) 49775, 49790

49803 **(AD-A—193008/0/XAB) Conjugacy of the aurora: high and low latitudes. Technical report.** Mizera, P.F.; Gorney, D.J.; Evans, D.S. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 5 Feb 1988. 18p. (TR—0086A(2940-06)-4). NTIS, PC A03/MF A01.

On December 5, 1983 the polar-orbiting satellites NOAA-7 and DMSP-F6, while in opposite hemispheres, each crossed a narrow structure of auroral electron precipitation at nearly the same Universal Time (UT) and at the same high magnetic-latitude, local time location. The Operational Line Scanner (OLS) image taken by DMSP-F6 of the northern polar region showed that this enhancement was associated with a sun-aligned arc (SAA) which extended poleward from the midnight sector auroral zone and passed across the polar cap very near to the magnetic pole. The DMSP-F6 plasma measurements showed particle precipitation at background levels in the regions adjacent to the SAA suggesting that those magnetic field lines connected to the interplanetary medium via the northern tail lobe. NOAA-7 observations show that the analogous precipitation structure in the southern hemisphere was embedded in a region of low intensity ion and electron precipitation which had the characteristics of the plasma-sheet population. Comparisons between the boundaries of the lower-latitude auroral zone precipitation and the electron distributions at those boundaries were also made. The results of these comparisons together with those made for the high-altitude SAA argue for a high degree of inter-hemisphere conjugacy in the electron precipitation over a wide range of invariant magnetic latitudes.

49804 **(AD-A—193022/1/XAB) Field-aligned structure of the storm time PC 5 wave of November 14-15, 1979.** Takahashi, K.; Higbie, P.R.; Fennell, J.F.; Amata, E. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 1 Feb 1988. 42p. (TR—0086A(2940-05)-3). NTIS, PC A03/MF A01.

Magnetic-field data from the four satellites--SCATHA (P78-2), GOES 2, GOES 3, and GEOS 2--have been analyzed to examine the magnetic-field-aligned structure of a storm-time Pc 5 wave that occurred on November 14-15, 1979. The wave had both transverse and compressional components. At a given instance, the compressional and the radial components oscillated in phase or 180 deg out of phase, and the compressional and the azimuthal components oscillated +90 or -90° out of phase. In addition, each component changed its amplitude with magnetic latitude: the compressional component had a minimum at the magnetic equator, whereas the transverse components had a maximum at the equator and minima several degrees off the equator. At 180° relative phase switching among the components occurred across the latitudes of amplitude minima. From these observations, the field-line displacement of the wave is confirmed to have an antisymmetric standing structure about the magnetic equator with a parallel wave length of a few earth radii. The authors also observed other intriguing properties of the wave, such as different parallel wavelengths of different field components and small-amplitude second harmonics near the nodes. A dielectric tensor appropriate for the ring-current plasma is found to give an explanation for the relation between the polarization and the propagation of the wave. However, plasma data available from SCATHA do not support either the drift-mirror instability of Hasegawa or the coupling between a drift-mirror wave and a shear wave Alfven wave, as discussed by Walker and coworkers.

49805 **(AD-A—193129/4/XAB) Approximate analytical formulae for electron density and collision frequency in the natural and nuclear-disturbed ionosphere and inner magnetosphere. Memorandum report.** Keskinen, M.J.; Fedder, J.A. (Naval Research Lab., Washington, DC (USA)). 22 Feb 1988. 27p. (NRL-MR—6134). NTIS, PC A03/MF A01.

The phenomenological models of global electron density for the natural ionosphere of Ching and Chiu (1973) and Chiu (1975) were extended to both lower (60 km) and higher (36,000 km) altitudes. Computer simulations of a high-altitude nuclear explosion are analyzed to develop a phenomenological model of electron density. Approximate analytical formulae for electron density and associated electron-collision frequency in both the natural and nuclear-distributed near-earth space-plasma environment are derived.

49806 **(AD-A—193200/3/XAB) Low-latitude auroral boundary: steady-state and time-dependent representations. Technical report.** Gorney, D.J.; Evans, D.S. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 25 Mar 1988. 32p. (TR—0086(2940-06)-3). NTIS, PC A03/MF A01.

Recently, extensive data sets have been acquired from charged-particle detectors on low-altitude satellites pertinent to the study of the low-latitude boundary of the aurorae, including both case studies and statistical treatments. The low-latitude auroral boundary can be thought of as the low-altitude manifestation of convection boundaries for magnetospheric particles of moderate energy, although the detailed shape of the boundary might be modified locally by spatial variations or temporal modulation of precipitation rates. Several attempts have been made to compare observed equatorial and low-altitude boundaries with theoretical representations, with varying degrees of success. Here, the results of statistical analysis and case studies of the auroral boundary using precipitating particle data acquired by the NOAA spacecraft are presented. The ability of standard convection models to account for the observed boundary characteristics is discussed, with emphasis on the roles of convection strength and time dependence. It is demonstrated that, within reasonable parameter limits, steady-state convection patterns for moderate-energy electrons generally fail to account for certain observed characteristics of boundary shapes.

49807 **(AD-A—193368/8/XAB) Dynamics of the auroral ionosphere during the breakup of a substorm. Final report, 28 January 1983-31 August 1986.** Silevitch, M.B. (Northeastern Univ., Boston, MA (USA)). 1 Mar 1988. 38p. NTIS, PC A03/MF A01.

The investigation described here concentrated on several dynamic features of substorm evolution during its breakup phase. More specifically, focus was on development of a model for propagation of the Westward Travelling Surge (WTS) as seen from the viewpoint of an active ionosphere. Also considered was a mechanism for the generation of Pi2 pulsations. An important feature of the approach is the natural coupling that exists between the WTS motion and the frequency spectrum of the Pi2 modes. Thus, the theory predicts the correlation of Pi2 waveforms to substorm onsets. This correlation seems to be a reasonable one in light of recent observations of substorm morphology.

49808 **(AD-A—193379/5/XAB) Scaling laws for geomagnetic tail current sheet acceleration. Environmental research papers.** Sherman, C. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 22 Jul 1987. 12p. (AFGL-TR—87-0235). NTIS, PC A03/MF A01.

Solutions of the equation describing proton acceleration in the electric field of the Earth's geomagnetic tail often require lengthy numerical calculations and parametric exploration can be difficult. Here, considerations are presented of a scaling nature and shown that these considerations may be used to extend, correlate, organize, and verify groups of solutions with regard to parametric variation.

49809 **(AD-A—193381/1/XAB) Electrodynamics of very-high-latitude arcs in the morning sector auroral zone.** Robinson, R.M.; Vondrak, R.R.; Hardy, D.; Gussenhoven, M.S.; Potemra, T.A. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1 Feb 1988. 12p. (AFGL-TR—88-0069). NTIS, PC A03/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 93, No. A2, 913-922(1 Feb 1988).

An experimental campaign was conducted to study the electrodynamics of auroral arcs at very high latitudes. The experiments involved coordinated observations by radar and two polar-orbiting spacecraft. For several hours around a system of auroral arcs was observed. These arcs varied in intensity and width but were all extended generally in the magnetic east-west direction. A satellite photograph obtained during the observations showed that two types of arcs were present. In the south the arcs were localized enhancements or striations within a broad diffuse aurora. Poleward of the diffuse aurora was a system of arc segments that extended over about 5 deg of latitude. The radar measured enhanced ionospheric electron densities associated with each of these arcs, although the altitudes of the enhancements were different for the two types. In the diffuse aurora the ionization peaked at altitudes near 115 km, whereas in the arc segments the ionization peaked at altitudes above 180 km. Examination of electric field data from the radar indicated that the boundary in ionization associated with the two types of aurora occurred where the southward electric field maximized. The HILAT satellite passed in the vicinity of Sondrestrom during the experiment and measured precipitating-electron fluxes and field-aligned currents.

49810 **(AD-A—193400/9/XAB) Using simultaneous particle and field observations on a low-altitude satellite to estimate Joule heat energy flow into the high-latitude ionosphere.** Rich, F.J.; Gussenhoven, M.S.; Greenspan, M.E. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). Jun 1987. 9p. (AFGL-TR—88-0068). NTIS, PC A02/MF A01.

Pub. in Annales Geophysicae, Vol. 5A, No. 6, 527-534(Jun 1987). Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

This report describes the background, the algorithm for calculating, and the early results of a survey of the Joule heat deposited in the high-latitude ionosphere. The algorithm is based upon data obtained with the polar-orbiting DMSP/F7 spacecraft. A significant portion of the energy input to the high-latitude ionosphere and thermosphere is transmitted from the magnetosphere to the ionosphere via precipitation of electrons and ions and via Joule heat. Several earlier spacecraft of the Defense Meteorological Satellite Program (DMSP) have carried sensors to measure the particle contribution to the energy low. The contribution from the precipitating particles has been extensively surveyed and reported. The DMSP/F7 is the first spacecraft of this series to carry sensors that allow the measurement of parameters which can be used to calculate the Joule heat input. This report is the beginning of a survey of the Joule heat.

49811 **(AD-A—193431/4/XAB) Lower-hybrid ion conics.** Crew, G.B.; Chang, T. (Boston Area Academic Consortium, Inc., MA (USA)). Nov 1987. 23p. NTIS, PC A03/MF A01.

Pub. in Physics of Space Plasmas, Vol. 6, 55-76(Nov 1987).

A theoretical overview of the formation of ion-conic velocity distributions is presented for those situations where the necessary ion heating is attributable to wave-particle interaction with lower-hybrid turbulence. Based on a discussion of the observations and the probable heating scenario, the relevant physics is abstracted to construct a mathematical model for the conic formation process. The discussion includes a brief tutorial covering the essentials of wave-particle interactions with these waves. While for the general case one must be content with a numerical solution to the problem, in some instances approximate analytic solutions may be obtained using asymptotic methods. These results are discussed in some detail, and important conclusions for the interpretation of observational data are drawn.

49812 **(AD-A—193434/8/XAB) Growing ion holes as the cause of auroral double layers.** Tetreault, D.J. (Massachusetts Inst. of Tech., Cambridge (USA)). Feb 1988. 5p. NTIS, PC A02/MF A01.

Pub. in Geophysical Research Letters, Vol. 15, No. 2, 164-167(Feb 1988).

The nonlinear ion-hole instability is proposed as the cause of intermittent double layers observed in the auroral-particle-acceleration region. A novel feature of the instability is its occurrance in plasma that is stable to linear ion-acoustic waves. A growing ion-hole has a double-layer potential structure. This demonstrated here that nonlinear hole instability is consistent with S3-3 and Viking satellite data. Instability thresholds, as well as characteristic double-layer amplitudes, potential drops, speeds, and scale sizes are calculated. The inadequacy of conventional laser instability models in explaining the data is discussed.

49813 **(AD-A—193886/9/XAB) Statistical and functional representations of the pattern of auroral energy flux, number flux, and conductivity.** Hardy, D.A.; Gussenhoven, M.S.; Raistrick, R. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1 Nov 1987. 22p. (AFGL-TR—88-0074). NTIS, PC A03/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 92, No. A11, 12,275-12,294(1 Nov 1987).

Global patterns of the integral energy flux and average energy of precipitating auroral electrons are used to determine the global pattern of the electron-produced, height-integrated Hall and Pedersen conductivities. The conductivities were determined in spatial bins in magnetic local time (MLT)-corrected geomagnetic latitude (CGL) coordinates for all MLTs and for CGLs greater than 50 deg and for seven levels of activity as measured by Kp. On the nightside the two conductivities increase with increasing Kp. The largest conductivities are found near midnight, where the peak value of the Pedersen (Hall) conductivity varies from 3.09 (4.05) mhos to 12.5 (25.9) mhos as Kp varies from 0 > or = 6-. At noon and on much of morning side of the oval the Pedersen and Hall conductivities increase for Kp up to 2 and then decrease for higher Kp. The highest ratios of the Hall to Pedersen conductivity are on the morning side of the oval and at noon. The peak conductivities on the dayside are significant compared to the conductivities produced by solar radiation at all seasons of the year. The global maps of the integral energy flux, integral number flux, and height-integrated Hall and Pedersen conductivities at each level of Kp were fit using both spherical harmonic and Epstein functions. The Epstein functions were found to reproduce better the original maps. At Kp = 2 the distribution of differences between the Epstein function fit and the original data is roughly symmetric about zero with a full width at half maximum of 16 (20)% for the Pedersen (Hall) conductivity and 32(40)% for the integral energy (number) flux. The distribution of difference broadens with increasing and decreasing activity.

49814 **(LA-UR—88-2223) Association of plasma sheet variations with auroral changes during substorms.** Hones, E.W. Jr.; Craven, J.D.; Frank, L.A.; Parks, G.K. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-880780—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014319/JAW.

From 27. plenary meeting of COSPAR; Espoo, Finland (18 Jul 1988).

Images of the southern auroral oval taken by the University of Iowa auroral imaging instrumentation on the Dynamics Explorer 1 satellite during an isolated substorm are correlated with plasma measurements made concurrently by the ISEE 1 satellite in the

magnetotail. Qualitative magnetic field configuration changes necessary to relate the plasma sheet boundary location to the latitude of the auroras are discussed. Evidence is presented that the longitudinal advances of the auroras after expansive phase onset are mappings of a neutral line lengthening across the near-tail. We observe a rapid poleward auroral surge, occurring about 1 hour after expansive phase onset, to coincide with the peak of the AL index and argue that the total set of observations at that time is consistent with the picture of a {open←quotes}poleward leap{close←quotes} of the electrojet marking the beginning of the substorm's recovery. 9 refs. 3 figs.

49815 (SAND—88-1039) Low intensity of conflict (LIC) communication system study (Phase I)←. Lupinetti, F.; Lee, C.E. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 149p. NTIS, PC A07. Order Number TI88015415/JAW.

A brief introduction on high frequency (HF) propagation in the ionosphere is presented. Relevant parameters for the proper operation of a shortwave communication link are addressed. Several examples using both tabulated values and computerized methods are discussed. A complete list of the international frequency allocation standards for commercial and private users is also furnished. 19 refs., 77 figs., 10 tabs.

49816 Assessment of the boundary layer model of the magnetospheric substorm. Nishida, A.; Bame, S.J.; Baker, D.N.; Gloeckler, G.; Scholer, M.; Smith, E.J.; Terasawa, T.; Tsurutani, B. (Institute of Space and Astronautical Science, Sagamihara, Japan). *Journal of Geophysical Research;* 93: No. A6, 5579-5588(1 Jun 1988).

Since the plasma sheet boundary layer has been identified as a site of fast streaming plasma, suggestions have been made that the features which have hitherto been taken as signatures of the formation of a neutral line in the near-Earth tail during the expansion phase of substorms can be interpreted differently in terms of the boundary layer characteristics. In order to determine if such suggestions are viable we have analyzed the ISEE 3 data obtained during one of its tail traversals at the distance of 80 R/sub E/. It has turned out that at this distance, which is intermediate between the near tail and the distant tail, the plasma sheet boundary layer does not represent a clearly definable entity in terms of the plasma flow characteristics, and thus it is fundamentally difficult to explain substorm observations at this distance in terms of any boundary layer model. Indeed, observations are quite consistent with the formation of a near-Earth neutral line during the expansion phase. The presence of the boundary layer at the ISEE 1 orbit (apogee: 23 R/sub E/) but not at 80 R/sub E/ suggests that the neutral sheet acceleration region which extends from the distant tail terminates somewhere between 80 and 23 R/sub E/. It is further noted that the correspondence between activities in the inner magnetosphere and in the tail may not be absolute one-to-one. copyright American Geophysical Union 1988

49817 Properties and dynamics of the electron beams emanating from magnetized plasma double layers. Borovsky, J.E. (Space Plasma Physics Group, Los Alamos National Laboratory, Los Alamos, New Mexico). *Journal of Geophysical Research;* 93: No. A6, 5713-5725(1 Jun 1988).

The properties of the electron beams that are produced by magnetized plasma double layers (which may reside in the auroral zone) are examined by means of particle-in-cell simulations, test particle simulations, and analytic theory. It is found that these beams are characterized by (1) a large degree of gyrophase bunching, (2) large T/sub perpendicular//T/sub parallel/ ratios, (3) very strong partialf/partialv/sub parallel/ gradients, and sometimes (4) a minimum in f(v/sub perpendicular/)/v/sub perpendicular/ near v/sub perpendicular/ = 0. The temporal modulation of the electron beams by the cyclic disruption and reformation of the magnetized double layers is quantified, and the disruption distance of the sheet-shaped electron beams via the Langmuir waves that they drive is estimated. copyright American Geophysical Union 1988

49818 Production of auroral kilometric radiation by gyrophase-bunched double-layer-emitted electrons: Antennae in the magnetospheric current regions. Borovsky, J.E. (Space Plasma Physics Group, Los Alamos National Laboratory, Los Alamos, New Mexico). *Journal of Geophysical Research;* 93: No. A6, 5727-5740(1 Jun 1988).

When temporally modulated, the gyrophase-bunched sheet beams of electrons that emanate from magnetized double layers may produce electromagnetic radiation with high efficiencies in narrow frequency bands $\Delta f \sim 200$ Hz, the electromagnetic waves being broadcast in the north-south (constant longitude) direction. For the modulated-beam mechanism, efficiencies, power levels, and polarizations are estimated. It is found that of the order of 160 auroral arcs that are each 10^3 km long are necessary to produce 10^9 W of radiation. Beam modulation mechanisms, auroral zone measurement techniques, and electromagnetic wave reflection are discussed, and a laboratory techniques, and electromagnetic wave reflection are discussed, and a laboratory experiment to study the modulated-beam emission mechanism is outlined. copyright American Geophysical Union 1988

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 49205, 49206, 49207, 49285, 49970, 49971, 50125, 50140, 50223

49819 (AD-A—193169/0/XAB) Electron-impact dissociation of HgX2 (X=Cl,Br,I). Kushawaha, V.; Mahmood, M. (Howard Univ., Washington, DC (USA). Dept. of Physics). 15 Sep 1987. 6p. NTIS, PC A02/MF A01.

Pub. in Jnl. of Applied Physics Vol. 62, No. 6, 2173-2177(15 Sep 1987).

Electron-impact dissociation of HgX_2 molecules was studied in the electron energy range of 1-100 eV. By using the most intense band of the B-X system of HgX (X = Cl,Br.I) radicals, emission cross sections were measured at different energies of the projectile electron. The threshold electron energy for the observation of the B-X band system was determined to be 7.0, 6.5, and 5.7 eV for $HgCl_2$,$HgBr_2$, and HgI_2 molecules, respectively. These energies are in good agreement with values previously reported by other investigators.

49820 (AD-A—193335/7/XAB) Cooperative effects and intrinsic optical bistability in collections of atoms. Interim periodic report No. 1, 1 October-30 November 1987. Ben-Aryeh, Y. (Technion Research and Development Foundation Ltd., Haifa (Israel)). 30 Nov 1987. 4p. NTIS, PC A02/MF A01.

In order to understand the basic nature of cooperative effects between different atoms, the cooperative effects between two atoms interacting one with another via the vacuum field and under the influence of applied coherent electromagnetic field were studied. The problem of resonance fluorescence from two two-level atoms was treated and a new treatment to this problem was developed by using the methods of Stenholm and Baklanov, which have been used previously only for one atom. The full and maximally simplified equations are presented so that anyone interested in the two-atom resonance fluorescence spectra can calculate it by use of a computer for any specific case. For the special case of two-level atoms within a distance smaller than a wavelength and for a strong external field, analytical results were developed.

49821 (AD-A—193866/1/XAB) Photoabsorption and photoionization cross sections of O, O_2, and N_2 for photoelectron production calculations: a compilation of recent laboratory measurements. Memorandum report. Conway, R.R. (Naval Research Lab., Washington, DC (USA)). 29 Mar 1988. 78p. (NRL-MR—6155). NTIS, PC A05/MF A01.

Recent laboratory measurements of photoionization cross sections and ion-state branching ratios for atomic oxygen, molecular nitrogen, and molecular oxygen are combined with theoretical cross sections for soft-x-ray absorption and tabulated for use in atmospheric photoionization calculations. The most important changes from earlier compilations for aeronomical calculations is a factor of approximately two reduction in the absorption and ioniza-

tion cross section of atomic oxygen between 100 and 300 angstroms, and a detailed treatment of partial cross sections for the dissociating state of N_2 and O_2. The results are tabulated on the wavelength scale of the Atmospheric Explorer solar reference spectrum SC 21REFW (Hinteregger et al., 1981).

49822 (CERN-EP—87-173) Production of short-lived positron sources. Sinapius, G.; Ravn, H.L. (European Organization for Nuclear Research, Geneva (Switzerland)). 22 Sep 1987. 9p. (CONF-8707186—1). NTIS (US Sales Only), PC A02; 1; GPO Dep. Order Number DE88013853/JAW.

From NATO advanced research workshop on atomic physics with positrons; London, UK (15 Jul 1987).

In all fields where low-energy positrons are employed, high intensities are desirable. The low-energy positrons originate from high-energy positrons that are moderated in solids. During the last decades the intensity of moderated positron beams has risen from less than one to 10^9 e^+/s. There are two ways to increase the density, either by having a higher flux of high-energy positrons hit the moderator or by using more efficient moderators. In this text we will only deal with the first option. 12 refs., 2 figs.

49823 (CONF-880435—22) Influence of stimulated Raman scattering on the conversion efficiency in four wave mixing. Wunderlich, R.; Moore, M.A.; Garrett, W.R.; Payne, M.G. (Oak Ridge National Lab., TN (USA); Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014566/JAW.

From 4. international symposium on resonance ionization spectroscopy and its applications; Gaithersburg, MD, USA (10 Apr 1988).

Secondary nonlinear optical effects following parametric four wave mixing in sodium vapor are investigated. The generated ultraviolet radiation induces stimulated Raman scattering and other four wave mixing process. Population transfer due to Raman transitions strongly influences the phase matching conditions for the primary mixing process. Pulse shortening and a reduction in conversion efficiency are observed. 8 refs., 3 figs.

49824 (CONF-880695—53) Development of a lithium liquid metal ion source for MeV ion beam analysis. Read, P.M.; Maskrey, J.T.; Alton, G.D. (UKAEA Harwell Lab.). 1988. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015559/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

Lithium liquid metal ion sources are an attractive complement to the existing gaseous ion sources that are extensively used for ion beam analysis. This is due in part to the high brightness of the liquid metal ion source and in part to the availability of a lithium ion beam. High brightness is of particular importance to MeV ion microprobes which are now approaching current density limitations on targets determined by the ion source. The availability of a lithium beam provides increased capabilities for hydrogen profiling and high resolution Rutherford backscattering spectrometry. This paper describes the design and performance of a lithium liquid metal ion source suitable for use on a 5MV Laddertron accelerator. Operational experience with the source and some of its uses for ion beam analysis are discussed. 8 refs., 2 figs.

49825 (CONF-880791—1) Surface imaging by positron emission. L.D. Hulett, Jr.; Pendyala, S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015290/JAW.

From 35. international field emission symposium; Oak Ridge, TN, USA (18 Jul 1988).

Monoenergetic ({open<-quote}slow{close<-quote}) positrons are becoming available in the form of beams having brightness sufficiently high for use in microscope and microprobe applications. When slow positrons are injected into certain solid materials they are re-emitted without need for an externally applied extraction field. This property suggests that a positron emission microscope will have useful capabilities and be less severely impaired by problems that extraction fields impose on electron emission devices. The principles involved in a positron emission microscope are discussed, and an estimate of resolutions that might be achieved in the near future is made. 10 refs., 2 figs

49826 (CONF-880948—1) Electron attachment properties of excited dielectric-gas molecules and their possible use for pulse power switching. Christophorou, L.G.; Hunter, S.R.; Pinnaduwage, L.A.; Datskos, P.G.; Carter, J.G. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88009705/JAW.

From 9. international conference on gas discharges and their applications; Venice, Italy (19 Sep 1988).

Recent findings on the delicate and often large dependence of the electron attachment (and detachment) processes on the internal ({approximately} vibrational) energy of dielectric-gas molecules are presented with specific reference to SO_2F_2 and several perfluorocarbons. Such effects are strongly dependent on the molecule and the mode (dissociative or nondissociative) of electron attachment and can be used—in a number of novel ways—to enhance the current switching efficiency, stability and recovery characteristics of high current spark gap closing and diffuse discharge opening and closing switches for pulsed power applications. Also, recent findings on the optically modified electron attachment properties of gases vin laser-induced electronic excitation are reported with reference to thiophenol (C_6H_5SH) and TMAE (tetrakis-dimethyl amino ethylene). The large enhancement (up to 10^6) in the electron attachment coefficient we have observed in some molecules after irradiation of the gas with uv excimer laser (from low to high), thereby providing a means for actively and repeatedly extinguishing the gas discharge (i.e. opening the switch). 10 refs., 8 figs.

49827 (CONF-8804141—4) Optical, mass, and auger spectra from e-bombarded KBr. Arakawa, E.T.; Kamada, M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015278/JAW.

From 11. Werner Brandt workshop on penetration phenomena of charged particles in water; Oak Ridge, TN, USA (14 Apr 1988).

We have measured the mass spectrum and optical emission lines of neutral potassium atoms ejected from KBr at T = 300{degree}K and 443{degree}K bombarded by 2-keV electrons. The room-temperature data may be complicated by the nonstoichiometry of the alkali-enriched sample surface and seem difficult to interpret. The high-temperature sample, which maintains the proper stoichiometry, produces data in support of gas-phase excitation of alkali atoms desorbed from the surface. 15 refs., 4 figs.

49828 (DOE/ER/60437—3) Electron microscope studies: Progress report for the period July 1, 1987 to June 30, 1988. Crewe, A.V.; Kapp, O.H. (Chicago Univ., IL (USA)). 1 Aug 1988. Contract FG02-86ER60437. 162p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88014797/JAW.

The work in our laboratory for the past year can be characterized as having had considerable success in our work on theoretical electron optics and in the biological use of our existing microscopes, but, on the other hand, we have encountered considerable frustration in our attempts to complete the construction of the Sub Angstrom STEM. With regard to theoretical electron optics, we have continued to pursue lines of inquiry which were opened up to us as a result of our previous work on the correction of third order aberrations. While the experimental proof of the sextupole concept is still some distance away, the number of theoretical investigations we have conducted on the system indicate that it should be possible to make it work. The logical outcome of this is the realization that we ought to begin investigating other remaining limitations to the resolution of a STEM. These considerations led to some work that was done on the correction of the fifth order aberrations. Another study of equal importance was the investigation we made on the use of a sextupole corrector in a transmission microscope of conventional design and the results here look quite promising. Other theoretical studies include some work which has recently been started on methods of characterization of electron beams. The reason for this study is that under normal circumstances when an

electron beam is generated in a canning microscope the resolution is atrocious and the shape of the focused spot of electrons is very poor. Further work has been done on three dimensional reconstruction with the general aim of improving the precision of reconstruction and also being able to do so in spite of the existence of noise. Biological work on the existing microscope has proceeded apace and a large number of investigations have been done. Although the principle effort has remained towards investigations of giant hemoglobins, other molecules have also been studied.

49829 **(HMI-B—447) Differential cross sections for ejection of electrons from helium and argon by bare heavy ions.** Schiwietz, G.; Platten, H.; Schneider, D.; Schneider, T.; Zeitz, W.; Musiol, K.; Kowallik, R.; Stolterfoht, N. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). Oct 1987. 35p. Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.).

A compilation is presented of results on experimentally determined cross sections for ejection of electrons from He and Ar atoms by C/sup 6+/, O/sup 8+/ and Ne/sup 10+/-ions of 5 MeV/amu incident energy. The data are given as a function of electron emission angle and energy of ejection. Angles from 0/sup 0/ to 160/sup 0/ are surveyed and electron energies range from 2 to 5000 eV. The doubly-differential cross sections have been integrated to obtain cross sections differential in energy and total electron production cross sections. In addition cross sections and mean energies for the emission of Ar-L and Ar-K Auger-electrons are given.

49830 (INIS-BR—1157, pp 37) **Some aspects of electron-phonon interaction for intermediate valence.** Menezes, O.L.T. de; Troper, A. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1981. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88703560/JAW. (CONF-8109291—).

From 7. Latin American symposium on solid state physics; Gramado, Brazil (14 Sep 1981).

49831 **(LA-UR—88-1802) Theoretical survey of muon catalyzed fusion.** Leon, M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 12p. (CONF-8805170—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014463/JAW.

From Muon catalyzed fusion workshop; Sanibel Island, FL, USA (2 May 1988).

The main steps in the muon-catalyzed d-t fusion cycle are given in this report. Most of the stages are very fast, and therefore do not contribute significantly to the cycling time. Thus at liquid H_2 densities ({phi} = 1 in the standard convention) the time for stopping the negative muon, its subsequent capture and deexcitation to the ground state is estimated to be {approximately} 10{sup{minus}11} sec.[1] The muon spends essentially all of its time in either the ($d\mu$) ground state, waiting for transfer to a ($t\mu$) ground state to occur, or in the ($t\mu$) ground state, writing for molecular formation to occur. Following the formation of this "mesomolecule" (actually a muonic molecular ion), deexcitation and fusion are again fast. Then the muon is (usually) liberated to go around again. We will discuss these steps in some detail. 5 refs., 3 figs.

49832 **(LA-UR—88-2189) Effects of modulated electron beams and cavities on reditrons.** Kwan, T.J.T.; Davis, H.A.; Fulton, R.D.; Sherwood, E.G. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-880713—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014317/JAW.

From 7. international conference on high-power particle beams; Karlsruhe, F.R. Germany (4 Jul 1988).

The virtual cathode, when formed in a cavity, can generate microwaves at different cavity modes depending on the geometry of the cavity. We found that the formation and the oscillation frequency of the virtual cathode in a reditron can be significantly influenced by cavity designs. The length of a cavity can play a role in frequency and mode selection. Our simulations showed that TM{sub 012} and TM{sub 033} were excited for cavity lengths of 15.0 cm and 22.5 cm, respectively. In addition to the cavity effects on reditrons, we discovered that highly modulated electron beams can be produced in reditrons. Full modulation (100{percent}) of the transmitted electron beam current has been confirmed in our simulations. We further showed that incorporation of an inverse diode configuration can achieve microwave production efficiency of 26{percent}. 11 refs., 8 figs.

49833 **(LSU—8013973) Coulomb states in atoms and solids.** Ortalano, D.M. (Louisiana State Univ., Baton Rouge (USA)). May 1988. 133p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88013973/JAW.

In this dissertation, an empirical quantum defect approach to describe the valence excitons of the rare gas solids is developed. These Coulomb states are of s-symmetry and form a hydrogen-like series which converges to the bottom of the lowest conduction band. A non-zero quantum defect is found for all of the excitons of neon, argon and xenon. For these systems, then, there exists, in addition to the screened Coulombic component, a non-Coulombic component to the total exciton binding energy. The Wannier formalism is, therefore, inappropriate for the excitons of Ne, Ar and Xe. From the sign of the quantum defect, the non-Coulombic potential is repulsive for Ne and Ar, attractive for Xe, and nearly zero for Kr. This is opposite to that for the Rydberg states of the corresponding rare gas atoms, where the non-Coulombic potential between the electron and the cation is attractive for all of the atoms. The excitons then, are not simply perturbed Rydberg states of the corresponding rare gas atoms (i.e., the excitons do not possess atomic parentage). Interatomic term value/band gap energy correlations and reduced term value/reduced band gap correlations were performed. These correlations were exploited to provide further evidence against both the Wannier formalism and the atomic parentage view point. From these correlations, it was also discovered that the non-Coulombic potential varies smoothly across the valence isoelectronic series of solids, and that it becomes more attractive (or less repulsive) in going from neon to xenon. In order to address the atomic parentage controversy, it was necessary to compare the excitons to the low-n Rydberg states of the rare gas atoms. A review of the quantum defect description of the atomic Rydberg states is, therefore, presented. Also, Rydberg term value/ionization energy correlations are discussed and compared with the analogous exciton correlations. 7 refs., 10 figs., 5 tabs.

49834 **(ORNL/TM—10844) Basic studies of gases for fast switches: Final report.** Hunter, S.R.; Christophorou, L.G. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 113p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88015378/JAW.

This final report covers the contract period October 1, 1982 to March 31, 1988, and includes an outline of the operation of diffuse discharge switches in pulsed power energy storage circuits, the methods by which the operation of these switches may be optimized, and the measurements we have performed on several gas mixtures which exhibit these optimized characteristics. The goal of the program has been to identify these optimization procedures, and using basic data on electron-atom and electron-molecule collision processes, to find gas mixtures in which the transport properties of the electrons in the gas discharges are "tailored" to match these optimization requirements. Using these criteria, we have found several gas mixtures which have very desirable characteristics for use in these switches. The potential of these gas mixtures has been demonstrated in recent switching experiments which have shown considerable operational improvements when these gases were used. 50 refs., 57 figs.

49835 **(PNL-SA—15381) Resonance ionization of Kr metastables using a single-frequency laser.** Cannon, B.D.; Janik, G.R. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1988. Contract AC06-76RL01830. 5p. (CONF-880435—23). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014757/JAW.

From 4. international symposium on resonance ionization spectroscopy and its applications; Gaithersburg, MD, USA (10 Apr 1988).

A continuous-wave single-frequency dye laser and an argon ion laser were sued to do 1-photon resonant, 2-photon ionization of the metastable $1s_3$ and $1s_5$ states of krypton to measure iostope shifts and hyperfine splittings for six transitions. Using only the dye

laser, we did 2-photon resonant, 3-photon ionization of the $1s_5$ metastable state of krypton via the 4d ,' state. We predict resonance ionization with high isotopic selectivity is possible using this state based, on the measured isotope shifts and hyperfine splittings. 4 refs., 3 figs.

49836 (SAND—87-0070) Analytical approximations for x-ray cross sections III. Biggs, F.; Lighthill, R. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 137p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88015366/JAW.

This report updates our previous work that provided analytical approximations to cross sections for both photoelectric absorption of photons by atoms and incoherent scattering of photons by atoms. This representation is convenient for use in programmable calculators and in computer programs to evaluate these cross sections numerically. The results apply to atoms of atomic numbers between 1 and 100 and for photon energies≧10 eV. The photoelectric cross sections are again approximated by four-term polynomials in reciprocal powers of the photon energy. There are now more fitting intervals, however, than were used previously. The incoherent-scattering cross sections are based on the Klein-Nishina relation, but use simpler approximate equations for efficient computer evaluation. We describe the averaging scheme for applying these atomic results to any composite material. The fitting coefficients are included in tables, and the cross sections are shown graphically. 100 graphs, 1 tab.

49837 Externally modulated intense relativistic electron beams. Friedman, M.; Krall, J.; Lau, Y.Y.; Serlin, V. (Plasma Physics Division, Naval Research Laboratory, Washington, DC 20375-5000). *Journal of Applied Physics;* **64**: No. 7, 3353-3379(1 Oct 1988).

The physics of modulation of an intense relativistic electron beam by an external microwave source is studied in this paper via experiment, theory, and simulation. It is found that the self-fields of the electron beam, in general, intensify the current modulation produced by the external source. The linear and nonlinear theory, together with the simulation, show that the classical klystron description in the drift tube region is substantially modified by the beam's high density. In the modulating gap, electron bunches may be generated instantaneously without the necessity of propagating the beam through a long drift tube. These properties, which have no counterparts in low-density beams, lead to the generation of large amplitude, coherent, and monochromatic current modulation on an intense beam. The excellent amplitude stability and the phase-locking characteristics ($<2^{\circ}$) of the modulated current, demonstrated in experiments, open new areas of research in high-power microwave generation and compact particle accelerators.

49838 Production of H^- ions with addition of cesium or xenon to a hydrogen discharge in a small multicusp ion source. Walther, S.R.; Leung, K.N.; Kunkel, W.B. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **64**: No. 7, 3424-3428(1 Oct 1988).

The effect on H^- ion production by adding cesium or xenon to a hydrogen discharge, in a small magnetically filtered multicusp ion source, has been investigated. Addition of cesium vapor to the hydrogen discharge resulted in a factor of 16 increase in H^- output relative to the uncesiated discharge for the same operating parameters. Likewise, the addition of xenon gas to a hydrogen discharge resulted in a factor of 2.7 increase in H^- output over pure hydrogen operation at optimum H_2 source pressure, while maintaining the same arc parameters. Operation of the source with the plasma electrode at optimum bias voltage was essential to obtain this result.

49839 Radiated power from short period undulators with a large magnet gap. Csonka, P.L.; Watanabe, H.; Tatchyn, R.O.; Toor, A. (Lawrence Livermore National Laboratory, P. O. Box 808, Livermore, California 94550). *Journal of Applied Physics;* **64**: No. 7, 3752-3753(1 Oct 1988).

The total power P/sub tot/ radiated by an electron beam passing through an undulator is studied as a function of the undulator wavelength λ/sub u/, while the magnet gap g remains fixed. As expected, for λ/sub u/>>g, the P/sub tot/ falls off exponentially for decreasing λ/sub u/, but for smaller λ/sub u/ the falloff is less steep and, in particular, for λ/sub u/→0, P/sub tot/ is asymptotically proportional to λ/sub u/.

49840 Site specific fragmentation in molecules: Auger-electron ion coincidence studies on N_2O. Murphy, R.; Eberhardt, W. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104). *Journal of Chemical Physics;* **89**: No. 7, 4054-4057(1 Oct 1988).

We have studied the electronic decay of an oxygen 1s core hole in N_2O and the subsequent fragmentation into ions. Coincidence studies between the energy resolved Auger electrons and the ions reveal the individual decay channels for the various doubly charged ionic configurations populated in the Auger decay of the core hole. The site specificity in these events is not absolutely confined to breaking only the O—NN bond, even though the excitation of a core hole at the oxygen site in the initial absorption event is localized. This localization is to some extent preserved in the Auger decay, which favors the participation of valence electrons having wave functions with a large overlap at the site of the initial oxygen core hole. However some of these electrons are also crucial in forming the ON—N bond or the bonding structure of the molecule as a whole, such that removal of these electrons in the Auger decay results in the total destruction of the molecular bond.

49841 Comment on: "Quantum scattering via the S-matrix version of the Kohn variational principle". Zhang, J.Z.H.; Miller, W.H. (Department of Chemistry, University of California and Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Journal of Chemical Physics;* **89**: No. 7, 4454-4454(1 Oct 1988).

Rescigno and Schneider(ref.2), have suggested a simplification in the S-matrix version of Kohn variational method. It is pointed out that their idea works not only for electron-atom/molecule scattering, but also for heavy particle reactive scattering. Applications to atomic hydrogen and fluorine reactions with molecular hydrogen are considered.(AIP)

49842 Nonresonant multiphoton ionization of calcium atoms in an intense laser field. DiMauro, L.F.; Kim, D.; Courtney, M.W.; Anselment, M. (Department of Chemistry, Brookhaven National Laboratories and Associated Universities, Upton, New York 11973). *Physical Review* [*Section*] *A: General Physics;* **38**: No. 5, 2338-2346(1 Sep 1988).

We have studied the single and double nonresonant multiphoton ionization of calcium atoms using both 532-nm and 1.06-μm radiation. These studies were conducted in the intensity regime of 10/sup 10/—10/sup 13/ W/cm². We use mass and angularly resolved electron-energy analysis in an attempt to gain insight into the dominant mechanisms responsible for ionization. An analysis is presented for intensity- and frequency-dependent results, and electron angular distributions are reduced in terms of atomic parameters derivable from lowest-order perturbation theory.

49843 Angle-resolved photoemission from the Ar 2p subshell. Lindle, D.W.; Medhurst, L.J.; Ferrett, T.A.; Heimann, P.A.; Piancastelli, M.N.; Liu, S.H.; Shirley, D.A.; Carlson, T.A.; Deshmukh, P.C.; Nasreen, G.; and others. (Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review* [*Section*] *A: General Physics;* **38**: No. 5, 2371-2374(1 Sep 1988).

The angular distribution for Ar 2p photoionization has been measured from just above threshold to 400 eV photon energy, and calculated in the same energy range using the relativistic random-phase approximation. The present experimental and theoretical results are in good agreement, but disagree somewhat with earlier Hartree-Fock (HF) calculations. The HF values are found to be significantly higher in the near-threshold region. Possible reasons for this discrepancy are discussed with relevance to the general understanding of inner-shell photoionization phenomena.

49844 Shortcomings of the Keldysh approximation. Milonni, P.W. (Theoretical Division (T-12), Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] A: General Physics;* **38**: No. 5, 2682-2685(1 Sep 1988).

A simple derivation of the Keldysh amplitude for the ionization of an atom by a strong field is presented using a perturbation expansion in the binding potential. It is shown that the "Keldysh approximation" is questionable under conditions of strong ionization, when there is substantial probability of removing the electron from its initial bound state. This is consistent with published numerical studies based on model binding potentials. It is argued that the Keldysh amplitude is not gauge invariant in the usual sense, and that it is effectively canceled in a conventional gauge-invariant formulation of strong-field perturbation theory.

49845 Dielectronic recombination coefficients for fluorine-like ions: The multiconfiguration Dirac-Fock calculations. Chen, M.H. (High Temperature Physics Division, Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **38**: No. 5, 2332-2337(1 Sep 1988).

Dielectronic recombination rate coefficients for the three initial states of the F-like ions have been calculated for six ions with Z = 26, 35, 42, 47, 54, and 63. The calculations were carried out in the isolated resonance approximation for temperatures in the range $0.01 \leqq T \leqq 9$ keV. The Auger and radiation rates for each autoionizing state were computed explicitly by use of the multiconfiguration Dirac-Fock model in intermediate coupling with configuration interaction. Comparison is made with previous calculations. The effect of relativity on the Coster-Kronig-type transitions is also discussed.

49846 Importance of vacancy cascades in argon recoil-ion charge-state distributions accompanied by coincident projectile-electron capture and loss. Levin, J.C.; O, C.; Cederquist, H.; Biedermann, C.; Sellin, I.A. (Department of Physics, University of Tennessee, Knoxville, Tennessee 37996-1200). *Physical Review [Section] A: General Physics;* **38**: No. 5, 2674-2677(1 Sep 1988).

Argon recoil-ion charge-state distributions produced by beams of 0.7-MeV/u Cl/sup 5+,8+,10+/ have been measured by time-of-flight (TOF) techniques in coincidence with single- and double-charge-changed projectiles. In an essential improvement to the usual multinomial description of ionization in the independent-electron-ejection model, we find that inclusion of one (two) Auger vacancy cascades significantly alters the description of the recoil-ion spectra corresponding to single (double) capture. The single- and double-projectile-electron loss and capture spectra strongly resemble each other, suggesting that loss of one or two projectile electrons is closely associated with loss of one or two target L electrons, respectively. These conclusions are consistent with impact parameters inferred from determinations of mean recoil energy.

49847 Scattering kernels for the muon diffusion equation. Rusjan, E.; Zweifel, P.F. (Center for Transport Theory and Mathematical Physics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061). *Physical Review [Section] A: General Physics;* **38**: No. 4, 1860-1865(15 Aug 1988).

Diffusion of muonic hydrogen atoms in gaseous hydrogen is studied. Scattering kernels are derived from the kinematics of an inelastic binary collision. The effect of rotations of the hydrogen molecules is treated by defining and computing an effective inelastic energy transfer Q/sub eff/. The Doppler effect is taken into account by averaging the cross sections over the Maxwellian velocity distribution of the target molecules.

49848 Intermediate-velocity atomic collisions. II. K-shell ionization and excitation in 8.6-MeV/amu Ca ions. Xu, X.; Montenegro, E.C.; Anholt, R.; Danzmann, K.; Meyerhof, W.E.; Schlachter, A.S.; Rude, B.S.; McDonald, R.J. (Department of Physics, Stanford University, Stanford, California 94305). *Physical Review [Section] A: General Physics;* **38**: No. 4, 1848-1853(15 Aug 1988).

Projectile K-shell ionization and excitation cross sections were measured for 8.6-MeV/amu Ca/sup 19+,18+/ beams incident on various gas targets. The ionization and excitation cross sections are compared with the Glauber approximation and with the plane-wave Born approximation. Various factors that may affect the ionization and the excitation cross sections in this intermediate-velocity regime, such as screening by the target electrons, polarization, and binding, are examined in order to establish their relative importance.

49849 Electron-impact ionization of heavy atomic ions. Pindzola, M.S.; Griffin, D.C.; Bottcher, C. (Department of Physics, Auburn University, Auburn, AL 36849). *AIP (American Institute of Physics) Conference Proceedings;* **168**: No. 1, 94-101(1 Aug 1988). (CONF-870919—).

From 6. topical conference on atomic processes in plasmas; Santa Fe, NM, USA (28 Sep 1987).

General theoretical methods for the calculation of direct and indirect processes in the electron-impact ionization of heavy atomic ions are reviewed. Cross section results for Xe^{50+} and U^{89+} are presented.

49850 Charge exchange stripping cell measurements over a wide pressure range. Colchin, R.J.; Roquemore, A.L.; Scott, S.D. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Review of Scientific Instruments;* **59**: No. 8, 1667-1669(Aug 1988).

The efficiency of the stripping cell incorporated in a charge exchange analyzer has been measured over a pressure range of 1.8—130 mTorr and over an energy range of 1—130 keV/amu. In these measurements, a beam of hydrogen atoms was ionized by helium gas. As a by-product of the measurements, the scattering cross section was also measured. At the lowest pressure, the scattering cross section compared well with those measured previously; at high pressure, the cross section no longer followed an energy power law. The analyzer efficiency (defined as the fraction of the atoms that is ionized and not lost through scattering) can be modeled over the entire range of energy and pressure by including the measured scattering cross sections.

49851 Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). 365p. (CONF-870789—). Cambridge University Press, The Ritt Building, Trumpington Street, Cambridge CB2 1RP. Order Number TI88014239/JAW. Contract FG02-85ER13421.

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

This book contains papers on the following topics: above threshold ionization and other high intensity processes in atoms; multiphoton processes in molecules; quantized externally driven chaotic systems; formation and decay of multiply excited states; and resonant coherent processes.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 49279, 49302, 49553, 50327

49852 (AD-A—193163/3/XAB) Phase and energy distribution of ions incident on electrodes in radio-frequency discharges. Hebner, G.A.; Kushner, M.J. (Spectra Technology, Inc., Bellevue, WA (USA)). 15 Sep 1987. 6p. NTIS, PC A02/MF A01.

Pub. in Jnl. of Applied Physics, Vol. 62, No. 6, 2256-2260(15 Sep 1987).

A Monte Carlo particle simulation and parametric models for the sheath voltage and thickness were used to calculate the arrival phase and energy of ions striking the electrodes in low-pressure capacitively coupled rf discharges. Ion phase and energy distributions are presented as a function of rf frequency, ion mass, rf voltage, dc bias, sheath thickness, and gas pressure. When the rf frequency is below the ion-response frequency, the ions arrive at the electrode in phase with the applied rf voltage. As the rf frequency increases, the highest ion-arrival probability shifts towards higher phase until, at sufficiently high frequencies, it is nearly uni-

form. The transition from a highly peaked ion phase distribution at low frequencies to a uniform distribution at high frequencies requires at least an order of magnitude change in rf frequency. The implication of these calculations on the electron energy distribution is discussed.

49853 **(AD-A—194120/2/XAB) Surface tension and viscosity with Lagrangian hydrodynamics on a triangular mesh. Memorandum report.** Fyfe, D.E.; Oran, E.S.; Fritts, M.J. (Naval Research Lab., Washington, DC (USA)). 18 Mar 1988. 61p. (NRL-MR—6185). NTIS, PC A04/MF A01.

Numerical algorithms for surface tension and viscosity are presented in the context of a Lagrangian treatment of incompressible hydrodynamics with a dynamically restructuring grid. New algorithms are given which update previous Lagrangian approaches in the code SPLISH. Test problems involving internal gravity and capillary waves, an oscillating droplet and a viscous shear layer are described. An example is given of a flow calculated in and around a viscous droplet with surface tension in a shear flow.

49854 **(DOE/ER/25031—1) Numerical methods for fluid flow problems: A progress report.** Mansfield, L.E. (Virginia Univ., Charlottesville (USA). Dept. of Applied Mathematics). Jul 1988. Contract FG05-87ER25031. 16p. (UVA—527356-AM-89-101). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014732/JAW.

During the past year research was done on the solution on multiprocessors of linear systems of equations arising from finite element of finite difference discretizations of partial differential equations. The systems considered were for the most part assumed to be positive definite but some of our work has involved unsymmetric systems. The multiprocessors we have used are the Intel iPSC/1 Hypercube at Oak Ridge and, since June, the Intel iPSC/2 Hypercube at the University of Virginia. Recently, we have also been using the multitasking feature on the Cray XMP/48 at the Pittsburgh Supercomputer Center in order to gain experience with a shared memory machine. 3 refs., 7 tabs.

49855 **(LA-UR—88-1742) 1-D closure models for slender 3-D viscoelastic free jets: von Karman flow geometry and elliptical cross section.** Bechtel, S.E.; Forest, M.G.; Holm, D.D.; Lin, K.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 14p. (CONF-880786—1). NTIS, PC A03. Order Number DE88014478/JAW.

From IUTAM meeting; Cincinnati, OH, USA (1 Jul 1988).

In this paper we derive one space dimensional, reduced systems of equations (1-D closure models) for viscoelastic free jets. We begin with the three-dimensional system of conservation laws and a Maxwell-Jeffreys constitutive law for an incompressible viscoelastic fluid. First, we exhibit exact truncations to a finite, closed system of 1-D equations based on classical velocity assumptions of von Karman. Next, we demonstrate that the 3-D free surface boundary conditions overconstrain these truncated systems, so that only a very limited class of solutions exist. We then proceed to derive approximate 1-D closure theories through a slender jet asymptotic scaling, combined with appropriate definitions of velocity, pressure and stress unknowns. Our nonaxisymmetric 1-D slender jet models incorporate the physical effects of inertia, viscoelasticity (viscosity, relaxation and retardation), gravity, surface tension, and properties of the ambient fluid, and include shear stresses and time dependence. Previous special 1-D slender jet models correspond to the lowest order equations in the present asymptotic theory by an a posteriori suppression to leading order of some of these effects, and a reduction to axisymmetry. Solutions of the lowest order system of equations in this asymptotic analysis are presented: For the special cases of elliptical inviscid and Newtonian free jets, subject to the effects of surface tension and gravity, our model predicts oscillation of the major axis of the free surface elliptical cross section between perpendicular directions with distance down the jet, and drawdown of the cross section, in agreement with observed behavior. 15 refs.

49856 **(PB—88-214390/XAB) Spectral characteristics of arc-heated low-density plasma flows. Nitrogen plasma. Technical report.** Watanabe, Y.; Hirabayashi, N. (National Aerospace Lab., Chofu, Tokyo (Japan)). 1987. 18p. (NAL-TR—952). NTIS, PC E03/MF A01.

Text in Japanese; abstract in English.

Emissions from the nitrogen-plasma flows produced in an arc-heated low-density wind tunnel were analyzed spectroscopically. The prominent emitters were identified as $N(2+)$ first negative, N_2 second positive and N_2 first positive systems. By measuring the rotational and vibrational intensity distributions in some bands of the $N(2+)$ first negative system, temperatures in the plenum chamber were determined to be in the range between 5500 and 6900 K. Intensity distributions in the N_2 first positive system seemed to be consistent with these temperatures. Molecular-state populations of N_2 and $N(2+)$ showed deviations from those expected from LTE relations. In the low-density test-section flows, vibrational temperatures determined by the $N(2+)$ first-negative system bands showed large difference from rotational temperatures. The N_2 first-positive system also showed non-equilibrium intensity distribution, which resembled those found in Lewis-Rayleigh afterglows. The possible excitation-emission mechanisms of these band-systems in the low-density plasma flows are discussed.

49857 **Coagulation in chaotic flows.** Muzzio, F.J.; Ottino, J.M. (Department of Chemical Engineering, University of Massachusetts, Amherst, Massachusetts 01003). *Physical Review [Section] A: General Physics;* **38**: No. 5, 2516-2524(1 Sep 1988).

We study coagulation in the flow field of a time-periodic deterministic chaotic flow and focus on the simplest case: point particles convected without diffusion and allowed to coagulate with probability 1 when the distance is less than d. An analysis of the underlying physics is presented. Under "well-mixed" conditions the system behaves as if the particles were moved by Brownian motion, and a simple kinetic model describes the main results. The poorly mixed case is considerably more complex. Spatial inhomogeneities result from competition between the rate of coagulation and mixing, and trapping and leaking of clusters due to Kolmogorov-Arnold-Moser surfaces.

49858 **Hypersonic, stratified gas flows past an obstacle: Direct simulation Monte Carlo calculations.** Roberts W.W. Jr.; Hausman, M.A. (Department of Applied Mathematics, University of Virginia, Charlottesville, Virginia 22903). *Journal of Computational Physics;* **77**: No. 2, 283-317(Aug 1988).

Computational studies of the three-dimensional hypersonic flow of rarefied, strongly stratified gas past an obstacle are carried out, the incident gas stratified in a direction transverse to the mean flow. An "N-body" computational code based on Monte Carlo techniques is developed for these purposes. Our primary interest is centered on the three-dimensional effects induced in the gas flow by a solid obstacle comparable in size to the gas height and collisional mean free path. Of the different types and shapes of obstacles studied, we focus herein on a cylindrical obstacle, assumed to be a diffuse elastic scatterer. The cylindrical obstacle is a short uniform pipe whose upstream end is fully open, facing directly into the flow, and whose downstream end is covered by a flat circular endplate containing an "orifice" at its center. For different choices of "orifice" diameter, the obstacle serves as a useful model of an impact probe (closed orifice) or scoop (closed, partially open, or fully open orifice) in a rapidly rotating strongly stratified gas (as in a gas centrifuge). The computed results show that the obstacle (in all cases studied, spanning the range from completely closed orifice to fully open orifice) induces large systematic motions in the gas, with strong radially inward driven flow in the direction of the gradient of density stratification, and correspondingly large density perturbations in these regions.

49859 **General magnetic reconnection, parallel electric fields, and helicity.** Schindler, K.; Hesse, M.; Birn, J. (Ruhr-Universitaet Bochum, Bochum, Federal Republic of Germany). *Journal of Geophysical Research;* **93**: No. A6, 5547-5557(1 Jun 1988).

Analyzing the qualitative three-dimensional magnetic structure of a plasmoid, we were led to reconsider the concept of magnetic reconnection from a general point of view. The properties of relatively simple magnetic field models provide a strong preference for one of two definitions of magnetic reconnection that exist in the literature. Any concept of magnetic reconnection defined in terms

of magnetic topology seems naturally restricted to cases where the magnetic field vanishes somewhere in the nonideal (diffusion) region. The main part of this paper is concerned with magnetic reconnection in nonvanishing magnetic fields (finite-B reconnection), which has attracted less attention in the past. We show that E/sub parallel/ (the electric field component parallel to the magnetic field) plays a crucial physical role in finite-B reconnection, and we present two theorems involving E/sub parallel/. The first states a necessary and sufficient condition on E/sub parallel/ for global reconnection to occur. Here the term "global" means the generic case where the breakdown of magnetic connection occurs for plasma elements that stay outside the nonideal region. The second theorem relates the change of magnetic helicity to E/sub parallel/ for cases where the electric field vanishes at large distances. That these results provide new insight into three-dimensional reconnection processes is illustrated in terms of the plasmoid configuration, which was our starting point. copyright American Geophysical Union 1988

6450 High Energy Physics

REFER ALSO TO CITATION(S) 49970

49860 (DOE/ER/40284—T1) Research accomplishments in particle physics: Annual progress report. (Boston Univ., MA (USA). Dept. of Physics). 10 Apr 1988. Contract AC02-86ER40284. 97p. NTIS, PC A05/MF A01. Order Number DE88013984/JAW.

This document presents our report of the research accomplishments of Boston University researchers in six projects in high energy physics research: Colliding Beams Physics; Proton Decay; Monopole Detection with MACRO; Precision Muon G-2 Experiment; Accelerator Design Physics; and Theoretical Physics.

49861 (DOE/ER/40319—2) [High energy particle physics]: Progress report covering the period from August 1, 1987 to July 31, 1988. (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1988. Contract FG05-87ER40319. 41p. NTIS, PC A04. Order Number DE88015461/JAW.

In this document the High Energy Physics Group reviews its accomplishments and progress during the past year and presents plans for continuing research during the next several years. Some of the topics discussed in this report are: completed fixed target experiments; applications of QCD to hard hadronic processes; top quark signatures at the Tevatron collider; searching for supersymmetry at e^+e/sup {minus}/ colliders; Monte Carlo simulations; and quantrum field theories.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 49438

49862 (AD-A—193805/9/XAB) Neutrino detection primer. Technical report. Callan, C.; Dyson, F.; Treiman, S. (Mitre Corp., McLean, VA (USA)). Mar 1988. 95p. (JSR—84-105). NTIS, PC A05/MF A01.

This report is intended to provide for non-expert readers a survey of natural and man-made neutrino sources and a critical review of various methods that have been proposed for their detection. Detection methods may be divided into two classes, those with very modest performance and might actually work, and those that promise spectacular performance but violate the laws of physics. Emphasis in this report is on the second class of methods. The purpose is not to describe in detail what is possible, but to establish firm limits beyond which all schemes for detection capability are impossible. The last two sections of the report are for advanced students only and should be skipped by the non-expert. They provide precise mathematical statements and proofs of the limits the laws of physics impose upon neutrino cross sections. The limits are neither simple nor obvious. Consequently, it may be useful to have their technical justification here put on record.

49863 (BNL—41485) Probing perturbative QCD and nuclei with large angle elastic scattering. Barton, D.S.; Bunce, G.M.; Carroll, A.S.; Gushue, S.; Makdisi, Y.I.; Heppelmann, S.; Courant, H.C.; Fang, G.Y.; Heller, K.J.; Marshak, M.L. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-8805142—18). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015198/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

The experiment reported here (AGS Exp. 834) seems particularly appropriate for a conference on the intersections of particles and nuclear physics. We have performed a new probe of aspects of perturbative QCD (pQCD) and the time evolution of hadrons inside nuclei. Simultaneously, we determined the momentum dependence of nuclear spectral functions. That is, we measured the momentum distribution of nucleons inside nuclei with a sensitivity to components well beyond the edge of the normal Fermi distribution. 5 refs., 5 figs.

49864 (CBPF-NF—030/87) Measurement of the Ds/sup +/ lifetime. Anjos, J.C.C. dos; Appel, J.A.; Bracker, S.B. and others. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 12p. (FERMILAB-Pub—87/29-E). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703956/JAW.

We have observed 99 decays of the charmed strange meson, the Ds/sup +/ (formerly called the F/sup +/), into the θ PI/sup +/ (61) and K-bar/sup */ /sup 0/ K/sup +/ (38) final states in Fermilab photoproduction experiment E-691. We determine the lifetime to be (.48/sub -.05//sup +.06/ +-.02) x/sup -12/s. Using our reported measurement of the Ds/sup 0/ lifetime, we calculate tau (Ds/sup +/) / tau(D/sup 0/)=(1.10 +-.15+-.04).

49865 (CERN-EP—87-210) A {tau}-charm factory at CERN. Kirkby, J. (European Organization for Nuclear Research, Geneva (Switzerland)). 17 Nov 1987. 23p. (CONF-8705287—1). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88013858/JAW.

From 2. international school of physics with low energy antiprotons: spectroscopy of light and heavy quarks; Erice-Trapani, Italy (24 May 1987).

We advocate a new experiment at CERN which will perform an extensive program of precise measurements to confront the Standard Model. The experiment will probe the fundamental constituents ν/sub {tau}/, {tau} and c with a sensitivity which exceeds present data by two-to-three orders of magnitude and, in addition, will make a definitive search for the gluonic matter of QCD. The experiment involves a compact high-resolution detector of advanced technology, integrated with an intense e/sup {plus}/e/sup {minus}/ storage ring. The storage ring has a luminosity L {equals} 10^{33} cm/sup {minus}2/ s/sup {minus}1/ at $\sqrt{s}$ {equals} 5 GeV and delivers data samples per year of 10^7 {tau}/sup {plus}/ {tau}/sup {minus}/, 10^7 c{bar c} or 10^{10} J/{psi} events, with very low backgrounds. The experiment makes extensive use of present CERN infra-structure, such as the LEP e/sup {plus}/e/sup {minus}/ injector (LIL, EPA and PS), the ISR transfer tunnels and the ISR experimental area. The experiment can be constructed within a three year period at an estimated cost of 44 MSF for the storage ring and 29 MSF for the detector. 4 refs., 5 figs., 7 tabs.

49866 (CERN-EP—88-26) A study of π and K production in 200 GeV/A proton-uranium and oxygen-uranium interactions using decay muons. Abreu, M.C.; Alimi, M.; Baglin, C.; Baldit, A.; Barreira, G.P.; Bedjidian, M.; Bordalo, P.; Borenstein, S.; Britz, J.; Bussiere, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 1987. 13p. (CONF-8708166—9). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012614/JAW.

From 6. international conference on ultra-relativistic nucleus-nucleus collisions; Nordkirchen, F.R. Germany (24 Aug 1987).

The like-sign dimuons copiously recorded in the NA38 experiment both in p{minus}U and O{minus}U reactions at 200 GeV/nucleon are interpreted as resulting from decays of π and K mesons in comparable proportions. The ++/{minus}{minus} ratio

is large (≅1.7) and ascribed to the K^+ being more copiously produced than the K/sup {minus}/. Both the average transverse momentum and the ++/{minus}{minus} ratio are comparable for p{minus}U and O{minus}U reactions, and both increase only slightly with the transverse energy E/sub T/.

49867 (CONF-8705241—4) Charm lifetime measurements from TASSO. Forden, G.E. (State Univ. of New York, Stony Brook (USA)). 9 Oct 1987. Contract AC02-80ER10699. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014571/JAW.

From 10. Warsaw symposium on elementary particle physics; Kazimierz, Poland (25 May 1987).

Recent measurements by TASSO of the lifetimes of charmed mesons is reviewed. The lifetime reported for the D/sub s/ meson utilizes the entire data sample collected. The lifetime of the neutral charmed meson, D/sup o/, is from a subsample of the total data set. Special emphases is given to the experimental procedures used.

49868 (DOE/ER/01195—T9) Production of charm mesons by high energy neutrons. Shipbaugh, C.L. (Illinois Univ., Urbana (USA). Graduate Coll.). 1988. Contract AC02-76ER01195. 134p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88014992/JAW.

The charmed mesons D{sup {plus+-minus}}, D{sup 0}, and D{sub s}{sup {plus+-minus}}, have been observed in neutron-nucleus collisions at the FNAL Tevatron. A sample of 134 {plus+-minus} 19 events as investigated in the decay D{sup {plus+-minus}} {yields} D{sup 0}{pi}{sup {plus+-minus}} with the subsequent decay mode D{sup 0} {yields} K{sup +}K{sup {minus}}. The cross section per nucleon for D{sup {plus+-minus}}, at most probable energy {radical}s = 35 GeV, was measured to be 2.11 {plus+-minus} .43 (plus+-minus}.63){mu}b/nucleon for 0.0 < x{sub f} < 0.14 ({bar x}{sub f} = .07). The branching ratio (BR) is defined as: BR {identical+-to} Br(D {yields} D{pi}) {times} BR(D {yields} K{sup +}K{sup {minus}}). The dependence of the cross section per nucleus on number of nucleons in target was fit to a form A {sup {alpha}} and it was found that {alpha} = .96 {plus+-minus} .17. A sample of 64 {plus+-minus} 16 D{sub s}{sup {plus+-minus}} events was investigates for the decay D{sub s}{sup {plus+-minus}} {yields} {phi}{pi}{sup {plus+-minus}}. The differential cross section for D{sub s}{sup {plus+-minus}} production averaged over the particle and antiparticle states is: BR.[1/2](d{sigma}(D{sub s}{sup +})/dx{sub f} + d{sigma}(D{sub s}{sup {minus}})) = 2.85 {plus+-minus} 0.80 {plus+-minus} .86 {mu}b/nucleon at x{sub f} = 0.175 where the first errors is statistical and the second error is systematic. The branching fraction is defined as BR {equivalent+-to} BR(D{sub s} {yields} {phi}{pi}), and a linear A dependence was assumed. An estimate of relative cross section is: 0.19 {plus+-minus} 0.09 at x{sub f} = 0. 36 refs., 43 figs., 5 tabs.

49869 (DOE/ER/40085—14) High energy physics at Tufts University: Progress report, July 16, 1987--July 15, 1988. Milburn, R.H. (Tufts Univ., Medford, MA (USA). Dept. of Physics). 15 Jul 1988. Contract AC02-83ER40085. 133p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88015115/JAW.

The past year is best characterized in production terms: the Tufts High Energy Physics Group has participated significantly in the successful manufacture of a great mass of raw scientific data and of a major detector system. In summary: the fixed-target study of charm production at Fermilab---Experiment E-769---has yielded upwards of 500 million recorded triggers on some 10^4 standard computer tapes, far more events than planned and a landmark in online data acquisition at an accelerator. The Fermilab 15-foot hydrogen-neon bubble chamber exposure to neutrinos---E-632---has concluded its second and final run yielding interactions from the Tevatron-neutrino spectrum generated by more than 4 {times} 10^{17} protons on target. This set of filmed events is unique for its high neutrino energy and is, moreover, augmented by electronic data identifying energetic muons from charged-current processes and by subsets of high-resolution recordings from specialized holographic and conventional cameras. The Soudan-II nucleon decay program has brought significant portions of its central calorimeter and its Tufts-manufactured veto shield into operation on-line and is preparing to enter an extended data-collection period this summer. These experimental accomplishments, each of them as part of an international collaboration, promise us a flow of new and interesting results during the coming years. Our small theory sub-group continues its prolific activities in several areas of high energy phenomenology. Our progress in each of these activities will be described in more detail in the report.

49870 (SLAC—324) Proceedings of the B-meson factory workshop, Stanford, CA. Friedsam, L. (ed.). (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Feb 1988. Contract AC03-76SF00515. 63p. (CONF-8709224—). NTIS, PC A04. Order Number DE88014229/JAW.

From B-meson factory workshop; Stanford, CA, USA (8 Sep 1987).

Separate abstracts were prepared for the individual papers in this paper. (DT)

49871 (SLAC-PEP-NOTE—152) Comments on the simultaneous measurement of charged and neutral components of multi-hadron events. Yamin, P. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). [1988]. Contract AC03-76SF00515. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014838/JAW.

Comprehensive measurement of neutral and charged secondary particles from the same event may not be necessary and is certainly difficult and expensive. {eta}(549), {rho}(770), ω(784), {phi}(1019), etc., have substantial all neutral or all charged decay modes and so can be studied separately. Correlations between the energy given to neutral and charged particles need not be obtained on an event by event basis. Suggestions for charged particles measurement with magnetic momentum analysis and neutral detection with no magnetic field will be presented. The purpose of this note is to point out the large amount of physics which can be learned by separately measuring charged (C) and neutral (N) events. If the two functions are combined within a single apparatus (CN), each is compromised and the range of accessible physics is not substantially broadened. 2 refs.

49872 (SLAC-PEP-NOTE—163) Direct measurement of muon polarization in e{sup +}e{sup {minus} {yields} {mu}{sup {minus}{mu}{sup +}. Limon, P.; Stevenson, M.L.; Wenzel, W.A. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). [1988]. Contract AC03-76SF00515. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015169/JAW.

Two detectors are considered that are thick enough to stop 15 GeV μ{sup+}, with polarimeters to measure the polarization. Nearly 4π coverage would require a uranium ball of 10^4 tons and a polarimeter of 3000–4000 tons. A more nearly feasible approach uses a small angle 1500 ton detector with uranium plus magnetized iron to focus the muons on to a 400 ton polarimeter.

49873 (SLAC-PEP-NOTE—164) Strange particle experiments at PEP. Hitlin, D.; Marx, J.; Yamin, P. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). [1988]. Contract AC03-76SF00515. 19p. (PEP—164). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015168/JAW.

A variety of problems including inclusive hadron production cross- sections and weak interaction effects can be studied by the measurement of strange particles from e/sup {plus}/e/sub {minus}/. For example, asymmetries and polarizations of a few percent may be present in Λ production. The measurement of Λ polarization, including a consideration of background effects is discussed. Several vertex detectors including streamer and wire chamber spectrometers with a number of magnetic field configurations merit further investigation. 6 refs., 4 tabs.

49874 (SLAC-PEP-NOTE—165) Parity-violating momentum correlations as a means of observing weak interactions in e{sup +}e{sup minus} {yields} hadrons. Klems, J.H. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 1988. Contract AC03-76SF00515. 4p. (PEP—165). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015167/JAW.

Parity violations in e{sup +}e{sup {minus}} {yields} hadrons may be detectable in correlations of the form ({rvec char}p{sub 1} {times} {rvec char}p{sub 2}).{rvec char}k{sub e} between two hadrons and the electron beam. In the absence of specific guidance as to where to look for an effect, it is noted that if the low yield of energetic hadrons observed in parity conserving processes at lower energies persists at PEP, then the weak interactions, for which the rate is enhanced by a factor of p{sub 1}p{sub 2}, may not be most easily observed by examining correlations between energetic hadrons in the plane perpendicular to the electron beam.

49875 (SLAC-PUB—4667) Search for axion production in Υ(1S) decays. Fairfield, K.H. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jun 1988. Contract AC03-76SF00515. 4p. (CONF-8709147—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015339/JAW.

From International symposium on the production and decay of heavy flavors; Stanford, CA, USA (1 Sep 1987).

We present a search for axion production in radiative Υ(1S) decays using the Crystal Ball detector. We find no evidence for a signal and give a new upper limit, Br[Υ(1S)→a{degree}γ] < 4 {times} 10/sup {minus}5/, for m/sub a/ < 2m/sub e/. Results from previous axion searches in both the Υ and J/{psi} systems are discussed and compared to theoretical predictions.

49876 Charged-hadron inclusive cross sections and fractions in e^+e^- annihilation at $\sqrt{s}$ = 29 GeV. Aihara, H.; Alston-Garnjost, M.; Avery, R.E.; Barbaro-Galtieri, A.; Barker, A.R.; Barnett, B.A.; Bauer, D.A.; Bay, A.; Bobbink, G.J.; Buchanan, C.D.; and others. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review Letters;* **61**: No. 11, 1263-1266(12 Sep 1988).

We report measurements of π/sup +- /,K/sup +- /, and p,p-bar inclusive cross sections and factions in e^+e^- annihilation at $\sqrt{s}$ = 29 GeV, for the momentum interval 0.01<z = p/p/sub beam/<0.90. The analysis is based on approximately 70 pb/sup -1/ of data collected with the TPC/2γ detector facility at SLAC storage ring PEP. Detector upgrades result in significantly improved momentum coverage and precision of the data, compared to previous measurements.

49877 Search for W→cs-bar, Z→cc-bar,bb-bar in muon-jet events at the CERN proton-antiproton collider. Ransdell, J. (Department of Physics, University of California, Riverside, California 92521). *Physical Review [Section] D: Particles and Fields;* **38**: No. 5, 1616-1618(1 Sep 1988).

A search for quark decays of the W and Z particles produced in proton-antiproton collisions at $\sqrt{s}$ of 630 GeV in the UA1 experiment at the CERN collider is described. The search was made in the channels W→cs-bar, Z→cc-bar,bb-bar where b and c quarks were identified by the presence of a high-p/sub T/ muon in or near a jet. Although these decay channels avoid the copious background of QCD produced light quark and gluon jets, it was not possible to detect a W or Z signal because of the large cross section for strong cc-bar and bb-bar production.

49878 Perspectives in e/sup +/e/sup -/ physics. Feldman, G. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA (US)). pp 451-468 of Physics in collision. Derrick, M. Teaneck, NJ; World Scientific Pub. Co. (1987). (CONF-860943—).

From 6. international conference on physics in collision; Chicago, IL, USA (3 Sep 1986).

It is clear that the study of e/sup +/e/sup -/ collisions has the power to probe what lies beyond the standard model. The authors are now designing and building the colliders which will take us into new energy regions. If nature cooperates, we will learn a great deal.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 49799, 49870, 49874, 49904, 49906, 49906, 49907

49879 (CERN-EP—87-165) The search for strongly interacting sparticles at supercolliders. Savoy-Navarro, A.; Zaganidis, N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 9 Sep 1987. 28p. (CONF-870184—2). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88013851/JAW.

From Workshop on future accelerators at high energies; La Thuile, Switzerland (7 Jan 1987).

The capabilities of the LHC and the SSC to search for high-mass gluinos and squarks are compared within the framework of supergravity. The possibilities of these two machines when using a general-purpose 4π detector, as well as their limitations when scanning the mass range from 200 GeV up to TeV, are discussed in detail. 9 refs., 12 figs., 5 tabs.

49880 (CONF-880601—41) Deterministic transport calculations of dose profiles due to proton beam irradiation. Filippone, W.L.; Smith, M.S.; Santoro, R.T.; Gabriel, T.A.; Alsmiller, R.G. Jr. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02. Order Number DE88012920/JAW.

From American Nuclear Society annual meeting; San Diego, CA, USA (12 Jun 1988).

Charged-particle transport calculations are most often carried out using the Monte Carlo technique. For example, the TIGER and EGS codes are used for electron transport calculations, while HETC models the transport of protons and heavy ions. In recent years there has been considerable progress in deterministic models of electron transport. Many of these models are also applicable to protons. In this paper we present discrete ordinates solutions to the Spencer-Lewis equation for protons. In its present form, our code calculates the energy deposition profile and primary proton flux in x-y geometry due to proton beam irradiation. Proton energies up to 0.4 GeV are permissible.

49881 (CONF-880688—2) Resonance photo and electroproduction as a probe of QCD. Close, F.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015544/JAW.

From Summer workshop of the continuous electron beam accelerator facility; Newport News, VA, USA (20 Jun 1988).

Analogies have been drawn between QCD where quarks build up hadrons, which in turn build up nuclei, and QED where electrons build up atoms, which in turn build up molecules. There has been a lot of talk about creating a quark theory of the nucleus in QCD by analogy with the way electrons build up molecules in QED. However, this seems to me to be a case of trying to run before you can walk, in that in QED the first step has been achieved, namely understanding atoms in terms of their electronic structure, but understanding molecules in QED is only understood in rather simple cases. In QCD the situation is even worse, in that we haven't even achieved the first step, namely in understanding how hadrons are built from quarks. We all believe that quarks are in the hadrons, and that at high momentum transfer we can apply perturbative QCD(pQCD). But to build the hadrons, we need pQCD and also non-perturbative QCD, which, at present, means building models to simulate the effects of the confinement. Insofar as any successful model of the nucleus will have it looking to a very good approximation as if it is made of nucleons, then I believe that first we have to understand the dynamics of quarks building the individual nucleons. Throughout this talk, I wanted to show how low-energy electron beams may help us deepen that understanding, and hopefully lead us towards the correct dynamical picture of the nucleon. 28 refs., 1 fig., 2 tabs.

49882 **(DOE/ER/40423—01-P8) Lectures on perturbative QCD, jets and the standard model: collider phenomenology.** Ellis, S.D. (California Univ., Santa Barbara (USA). Inst. for Theoretical Physics; Washington Univ., Seattle (USA). Dept. of Physics). [1988]. Contract AS06-88ER40423. 30p. (NSF-ITP—88-55; CONF-8707192—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015519/JAW.

From Theoretical advanced study institute meeting; Santa Fe, NM, USA (1 Jul 1987).

Applications of the Standard Model to the description of physics at hadron colliders are discussed. Particular attention is paid to the use of jets to characterize this physics. The issue of identifying physics beyond the Standard Model is also discussed. 59 refs., 6 figs., 4 tabs.

49883 **(IFUSP-P—665) Quark structure of the nucleon and quantum hadrodynamics.** Frederico, T.; Carlson, B.V.; Rego, R.A.; Hussein, M.S. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). (Sao Paulo Univ. (Brazil). Inst. de Fisica). Oct 1987. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703984/JAW.

The effect of the quark structure of the nucleon on nuclear matter properties is investigated within a σ-ω-q model. We have found that in order to reproduce the known properties of normal nuclear matter, the mass of the scalar meson must decrease with increasing nuclear density, in accord with the recent finding of Bernard, Meissner and Zahed.

49884 **(LA-UR—88-2022) Exchange effects in double beta decay.** Stephenson, G.J. Jr.; Goldman, T.; Maltman, K.R.; Schmidt, K.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-8805142—16). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014427/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

Over the past decade there has been very impressive progress in the laboratory study of double beta decay with very precise limits on 0-neutrino decay in {sup 76}Ge, the imminent prospect of the observation of 2-neutrino decay in {sup 100}Mo and the first laboratory observation of 2-neutrino decay in {sup 82}Se. For the last case, the laboratory rate is in essential agreement with geochemical results and in reasonable agreement with theoretical predictions based on a full shell model calculation. The motivation underlying the resurgence of interest in double beta decay is the hope that the observation of, or limits on the 0-neutrino mode will provide information about the nature of the neutrino. This clearly requires confidence in the nuclear matrix elements involved in the transition. The shell model calculations do not agree well with the geochemical values for {sup 130}Te, which has led to a spate of papers offering specific fixes for the problem. In this contribution we shall not comment on any of the specific nuclear calculations, rather we make some remarks which should be relevant to any model calculation. 11 refs., 1 tab.

49885 **(RAL—88-046) Y -> Y π π decay: a challenge for heavy quark dynamics not π π physics.** Morgan, D.; Pennington, M.R. (Rutherford Appleton Lab., Chilton (UK); Brookhaven National Lab., Upton, NY (USA)). (Rutherford Appleton Lab., Chilton (UK)). May 1988. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754773/JAW.

The distinctive π π spectrum observed in Y -> Y π π decay has been ascribed by various authors to the presence of a low mass σ-resonance. Such an explanation is shown to have unacceptable consequences.

49886 **(RRK—88-5) Kac formulas for the extended Virasoro algebras.** Soda, Jiro; Yoshii, Hisahiro. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Feb 1988. 11p. NTIS (US Sales Only), PC A03/MF A01; GPO Dep. Order Number DE88754574/JAW.

The determination method of the conformal dimension (Kac formula) of the primary fields in the minimal models with c < 1 from the point of G/H picture is generalized. As a result all the known formulas are reproduced. Furthermore the rather general Kac formulas are derived. The connection between the ordinary method and our method is discussed.

49887 **(SLAC-PEP-NOTE—157) Report of the Weak Interactions/EM Final States Group.** (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 1973. Contract AC03-76SF00515. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015161/JAW.

In the reaction e^+e/sup {minus}/ $\rightarrow$ $\mu^+\mu$/sup {minus}/ the interference of weak and electromagnetic amplitudes is expected to produce measurable effects at the highest PEP energies in runs with integrated luminosities of order 10^{38}cm/sup {minus}2/. The prediction for $\mu^+\mu$/sup {minus}/ polar asymmetry and absolute rate, which give g/sub A/^{2} and g/sub V/^{2}, respectively, are highly model dependent. The s-dependence of these effects is sensitive to the existence of an intermediate boson with mass in the range below 100 GeV. The use of transverse electron beam polarization should be helpful in sorting out higher order electromagnetic effects. It is of negligible statistical advantage in determining the weak-electromagnetic interference terms. More difficult experiments requiring longitudinal beam polarization or the measurement of muon helicity could determine the weak V-A interference terms and provide a test of μ–e universality. 2 refs., 6 figs.

49888 **(SLAC-PEP-NOTE—174) New particle searches at PEP.** Berley, D.; Bulos, F.; Cheng, D.; Cork, B.; Limon, P.; Litke, A.; Nauenberg, U.; Rosen, J.; Shen, B.; Sulak, L. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 1988. Contract AC03-76SF00515. 75p. (PEP—174). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015174/JAW.

The new particles that could be produced at PEP are discussed in terms of their specific signatures and production rates. We find that a small number of general signatures characterize these particles. Backgrounds associated with the general signatures are considered and necessary rejection rates are calculated. We describe several typical detectors and tabulate the requirements they place on the PEP machine and the experimental areas. 10 figs., 2 tabs.

49889 **(UWThPh—1988-8) Signatures for sneutrino and squark production in ep collisions.** Bartl, A.; Fraas, H.; Majerotto, W. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik; Wuerzburg Univ. (Germany, F.R.). Physikalisches Inst.; Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1988. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704067/JAW.

Sneutrino and squark production in ep collisions, e+p-> ν-tilde+q-tilde+X, is studied in detail. In order to find the possible experimental signatures, particular attention is paid to the various decay possibilities of sneutrinos and squarks. Formulae for the cross section, decay probabilities and distributions are presented including general mixing of gauginos and higgsinos. Numerical results for characteristic mixing possibilities and various sneutrino and squark masses are given. 18 refs., 5 figs., 6 tabs.

49890 **(UWThPh—1988-16) Non-relativistic potential models. A qualitative survey.** Schoeberl, F. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1988. 61p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704071/JAW.

It is well accepted that hadrons are to be considered as bound states of quarks. The forces between quarks are not sufficiently known but there are experimental data (e.g. the hadron spectrum) to extract the most salient features of the potential. In the paper the most important features of the potential models are determined by simple analytical methods. 9 refs., 3 tabs. (qui).

49891 **Slightly massive photon.** Suzuki, M. (Department of Physics and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 5, 1544-1550(1 Sep 1988).

We study a renormalizable field-theory model of a slightly massive photon compatible with experiment. Such a model can be built only by spontaneous breaking of electromagnetic gauge symmetry which is triggered by a charged Higgs field with a tiny charge Q/sub chi/ in units of the proton charge. A physical-Higgs-boson mass m/sub h/ must obey an inequality Q/sub chi/m/sub h/ approx. <10/sup -20/ MeV. If m/sub h/ is smaller than 10 keV or so, a mass-independent upper limit is imposed on Q/sub chi/ by astrophysics as Q/sub chi/<10/sup -7/. Since this Higgs boson is almost decoupled from all known particles, there are very few physical consequences.

49892 **Formation of the pseudoscalars π0, eta, and eta' in the reaction $\gamma\gamma\rightarrow\gamma\gamma$.** Williams, D.A.; Antreasyan, D.; Bartels, H.W.; Besset, D.; Bieler, C.; Bienlein, J.K.; Bizzeti, A.; Bloom, E.D.; Brock, I.; Brockmueller, K.; and others. (California Institute of Technology, Pasadena, California 91125). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 5, 1365-1376(1 Sep 1988).

Tne Crystal Ball detector has been used at the DORIS II storage ring at DESY to study the reaction $e^+e^-\rightarrow e^+e^-\gamma^*\gamma^*\rightarrow e^+e^-\gamma\gamma$, where X is a narrow resonance with mass between 100 and 3000 MeV. Formation of π^0, eta, and eta' mesons is observed, and the following meson partial widths are obtained: Γ/sub π/$_0$/sub Γ/$_0$/sub $\rightarrow$//sub γ//sub γ/ = 7.7 +- 0.5 +- 0.5 eV, Γ/sub eta//sub -//sub γ//sub γ/ = 0.514 +- 0.017 +- 0.035 keV, and Γ/sub eta// sub '//sub $\rightarrow$//sub γ//sub γ/ = 4.7 +- 0.5 +- 0.5 keV. No other narrow resonances are observed, and upper limits are given for the product Γ/sub X//sub $\rightarrow$//sub γ//sub γ/B/sub X//sub $\rightarrow$//sub γ//sub γ/. .AE

49893 **Heavy-Higgs-boson production and vector-boson scattering processes in e^+e^- collisions at high energy.** Tofighi-Niaki, A.; Gunion, J.F. (Department of Physics, University of California, Davis, California 95616). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 5, 1433-1438(1 Sep 1988).

We study the reactions $e^-e^+\rightarrow\nu$nu-barZZ and $e^-e^+\rightarrow e^-e^+$ZZ using exact matrix elements. In particular, we examine the cross section for the production of a standard-model Higgs boson at several machine energies. In addition, we study the behavior of the vector-boson scattering processes when the Higgs-boson mass is infinite, focusing on the percentage of longitudinally polarized Z's as a signature.

49894 **Model dependence of the chargino mass bound from the CERN collider data.** Baer, H.; Hagiwara, K.; Tata, X. (Department of Physics, Florida State University, Tallahassee, Florida 32305). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 5, 1485-1490(1 Sep 1988).

We examine the validity of the limit (m/sub W-tilde/approx. >40 GeV) on the chargino mass that was inferred from the UA1 bound (m/sub L/$\geq$41 GeV) on the sequential heavy-lepton mass. This limit was obtained under the assumption that the supersymmetry-breaking gaugino masses are small (m/sub g-italic-tilde/ approx. <50 GeV) so that the lightest neutralino (Z-tilde$_1$) is dominantly a photino with m/sub gamma-tilde/<8 GeV. For larger gluino masses, we find that there is a substantial region of parameter space of the minimal supersymmetric model where (m/sub W-tilde/-m/sub Z-tilde//sub =/) is rather small so that m/sub W-tilde/ as small as 20—25 GeV is not excluded by the CERN collider data. Multilepton signals from gaugino decays are also commented upon.

49895 **Substructure of the strongly interacting Higgs sector.** Rosenfeld, R.; Rosner, J.L. (Enrico Fermi Institute and Department of Physics, University of Chicago, Chicago, Illinois 60637). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 5, 1530-1543(1 Sep 1988).

If the electroweak symmetry-breaking sector becomes strong at energies above 1 TeV as a result of the absence of a low-mass Higgs boson, and if only the minimal complement of Higgs particles is present, one expects an isovector spin-1 meson of mass 2 TeV/c^2, and width 400 GeV, decaying mostly to W/sup +- /Z or W^+W^-, on very general grounds. Thus, if longitudinal W's and Z's and Higgs bosons are actually fermion-antifermion composites, one must study systems other than this heavy vector meson to learn the nature of the constituents. The role in such studies played by the corresponding spin-1 isoscalar meson, also expected to have a mass of $\simeq$2 TeV/c^2, is examined, and compared with the corresponding role played by the ω in hadron physics.

49896 **Meson properties at finite density from SU(3)/sub f/ quark dynamics.** Bernard, V.; Meissner, U. (Center for Theoretical Physics, Laboratory for Nuclear Science dge, Massachusetts 02139). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 5, 1551-1555(1 Sep 1988).

We investigate the properties of pseudoscalar and scalar mesons and the quark condensates at finite density in the context of a generalized three-flavor Nambu—Jona-Lasinio model. As in a previous study of the two-flavor case, the decrease of the scalar-meson mass with increasing density suggests a softening of the nuclear equation of state. The axial U(1) anomaly is not affected by density as signaled by a constant mass of the eta'. We furthermore discuss some properties of the scalar mesons at zero density.

49897 **Aspects of the chiral quark model.** Jain, P.; Johnson, R.; Schechter, J. (Physics Department, Syracuse University, Syracuse, New York 13244-1130). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 5, 1571-1583(1 Sep 1988).

We point out intriguing connections between the chiral quark model in which the nucleon is treated as a soliton and the ordinary potential-binding quark model. The axial-vector coupling comes out near the value (5/3 rather than around 0.7 as in the Skyrme description and can be easily "fine-tuned" to its experimental value. A "linear potential" in some sense is generated as a collective effect of the "meson cloud." Contact with QCD is made by introducing a gluonium field so as to satisfy the trace-anomaly equation. In the simplest treatment of this field one predicts a scalar-isoscalar state at 900 MeV in agreement with a recent analysis of experiments. The model is used to discuss how a "nontrivial winding number" emerges for the meson fields. A number of additional features of the model are treated.

49898 **Properties of gluon jets.** Sugano, K. (Argonne National Lab., Argonne, IL (US)). pp 365-392 of Physics in collision. Derrick, M. Teaneck, NJ; World Scientific Pub. Co. (1987). (CONF-860943—).

From 6. international conference on physics in collision; Chicago, IL, USA (3 Sep 1986).

The properties of gluon jets are reviewed, and the measured characteristics are compared to the theoretical expectations. Although neither data nor models for the gluon jets are in the mature stage, in general the agreement between experiment and theory is remarkable. There are some intriguing differences. Since the properties of gluon jets are deeply rooted in the basic structure of non-Abelian gauge theory, the study of gluon jets casts further light on our understanding of QCD. Finally, the future prospects are discussed.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 49894, 49895, 49896, 49897

49899 **(CBPF-NF—021/87) On the labeling and symmetry adaptation of the solvable finite groups representations.** Caride, A.O.; Zanette, S.I.; Nogueira, S.R.A. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703954/JAW.

We propose a method to simultaneously perform a symmetry adaptation and a labeling of the bases of the irreducible representations of the solvable finite groups. It is performed by difining a self-adjoint operator with ligenvalues which evidence the descent in

symmetry of the group-subgroups sequences. We also prove two theorems on the canonicity of the cpomposition series of the solvable groups.

49900 **(IFUSP-P—635) Analytic stochastic regularization and gauge theories.** Abdalla, E.; Gomes, M.; Abdalla, M.C.B.; Lima-Santos, A. (Sao Paulo Univ. (Brazil). Inst. de Fisica; Instituto de Fisica Teorica, Sao Paulo (Brazil); UNESP, Rio Claro (Brazil). Inst. de Geociencias e Ciencias Exatas). (Sao Paulo Univ. (Brazil). Inst. de Fisica). Apr 1987. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703976/JAW.

We prove that analytic stochatic regularization braks gauge invariance. This is done by an explicit one loop calculation of the two three and four point vertex functions of the gluon field in scalar chromodynamics, which turns out not to be geuge invariant. We analyse the counter term structure, Langevin equations and the construction of composite operators in the general framework of stochastic quantization.

49901 **(IFUSP-P—641) Dirac Bracket Quantization of Bosonized chiral QCD2.** Abdalla, E.; Rothe, K.D. (Sao Paulo Univ. (Brazil). Inst. de Fisica; Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Fisica). (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1987. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703977/JAW.

We systematically derive the bosonized form of the chiral QCD/sub 2/ Zagrangean exchibiting explicitely the anomalous breaking of gauge invariance and quantize it using Dirac's algorithm for constrained systems. As a side product we also discuss the Hamiltonean formalism for the principal sigma model, and derive the commutation relations of the chiral currents in both models.

49902 **(INIS-BR—1211) Supersymmetry at finite temperature.** Oliveira, M.W. de. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Fisica). 1986. 171p. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704003/JAW.

The consequences of the incorporation of finite temperature effects in fields theories are investigated. Particularly, we consider the supersymmetric non-linear sigma model, calculating the effective potencial in the large N limit. Initially, we present the 1/N expantion formalism and, for the O(N) model of scalar field, we show the impossibility of spontaneous symmetry breaking. Next, we study the same model at finite temperature and in the presence of conserved charges (the O(N) symmetry's generator). We conclude that these conserved charges explicitly break the symmetry. We introduce a calculation method for the thermodynamic potential of the theory in the presence of chemical potentials. We present an introduction to Supersymmetry in the aim of describing some important concepts for the treatment at $T>0$. We show that Suppersymmetry is broken for any $T>0$, in opposition to what one expects, by the solution of the Hierachy Problem.

49903 **(INIS-BR—1221) Introduction to sympersymmetry.** Mattos, O.A. de. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Fisica). 1986. 232p. (In Portuguese). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88704013/JAW.

In the present work, supersymmetry is motivated via the Coleman-Mandula Theorem. Next, we build SUSY' algebra and representations (particularly, field representation). We then introduce the conceots of superspace and superfield, as well as supermultiplets and their invariants. Our next step is to examine simple models, in order to study auxiliary fields and the off-shell representations, to calculate the super-current and to show with supergraphs the loops cancelation (Wess-Zumino) and SUSY breaking (O'Raifeartaigh). Next, we obtain the supersymetric extension of the QED Lagrangean in to different ways, and them we are able to investigate symmetry breaking in supersymmetric gauge theories, and the appearance of Goldstone fermions. Finally, we study n-extended SUSY and the role of central charges, and examine SUSY in $d > 4$ dimensions and dimensional reduction. We end up with an introduction to Lie groups.

49904 **(LBL—25372) Issues in standard model symmetry breaking.** Golden, M. (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract AC03-76SF00098. 45p. NTIS, PC A03. Order Number DE88016643/JAW.

This work discusses the symmetry breaking sector of the SU(2) x U(1) electroweak model. The first two chapters discuss Higgs masses in two simple Higgs models. The author proves low-enery theorems for the symmetry breaking sector: The threshold behavior of gauge-boson scattering is completely determined, whenever the symmetry breaking sector meets certain simple conditions. The author uses these theorems to derive event rates for the superconducting super collider (SSC). The author shows that the SSC may be able to determine whether the interactions of the symmetry breaking sector are strong or weak. 54 refs.

49905 **(LYCEN—8755) Lie algebras under constraints and nonbijective canonical transformations.** Kibler, M.; Winternitz, P. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Oct 1987. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754741/JAW.

The concept of a Lie algebra under constraints is developed in connection with the theory of nonbijective canonical transformations. A finite dimensional vector space M, carrying a faithful linear representation of a Lie algebra L, is mapped into a lower dimensional space antiM in such a maner that a subalgebra L/sub 0/ of L is mapped into D(L/sub 0/) = 0. The Lie algebra L under the constraint D(L/sub 0/) = 0 is the largest subalgebra L/sub 1/ of L that can be represented faithfully on antiM. If L/sub 0/ is semi-simple, then L/sub 1/ is shown to be the centraliser cent/sub L/L/sub 0/. If L is semi-simple and L/sub 0/ is an one-dimensional diagonal subalgebra of a Cartan subalgebra of L, then L/sub 1/ is shown to be the factor algebra cent/sub L/L/sub 0//L/sub 0/. The latter two results are applied to nonbijective canonical transformations generalizing the Kustaanheimo-Stiefel transformation.

49906 **ϵ'/ϵ and the electric dipole moment of the neutron in left-right-symmetric models.** He, X.; McKellar, B.H.J.; Pakvasa, S. (School of Physics, University of Melbourne, Parkville, Victoria, 3052, Australia). *Physical Review Letters;* **61**: No. 11, 1267-1270(12 Sep 1988).

We observe that the recent results of ϵ'/ϵ enable us to place a lower bound on the left-right mixing parameter ξ in pseudomanifest left-right-symmetric models: $\tan\xi \geq 2.0 \times 10^{-6}$. We give the complete expression for the neutron electric dipole moment D/sub n/ and show that it satisfies $D/\text{sub } n/ < 7.6 \times 10^{-24}$ (e cm). In a particular model, due to Chang, we can relate D/sub n/ to ϵ'/ϵ and place limits on D/sub n/: 1.9×10^{-26} (e cm) $\geq$ chemical bond D/sub n/chemical bond $\geq 1.9 \times 10^{-27}$ (e cm).

49907 **<qq-bar> and higher-dimensional-condensate contributions to the nonperturbative quark mass.** Elias, V.; Steele, T.G.; Scadron, M.D. (Department of Applied Mathematics, University of Western Ontario, London, Ontario, Canada N6A 5B9). *Physical Review [Section] D: Particles and Fields;* **38**: No. 5, 1584-1605(1 Sep 1988).

Dimension-3, -4, and -5 condensate contributions to the quark propagator are evaluated in the presence of a nonzero current-quark mass (m/sub L/) explicitly breaking Lagrangian chiral symmetry through the use of an operator-product expansion (OPE) of appropriate nonperturbative vacuum expectation values in the fixed-point gauge. A gauge-parameter-independent shift away from the purely perturbative propagator pole at m/sub L/ is seen to occur, provided the corrected pole is identified self-consistently with the OPE mass parameter, a mass which differs from m/sub L/ by incorporating contributions from nonperturbative condensates. The results obtained are argued to be valid to all orders in the OPE, and are shown to encompass the entire $O(g/\text{sub } s/^2)$ contribution of nonperturbative condensates to the quark propagator. Phenomenological consequences at (and near) the m/sub L/ = 0 chiral limit are also discussed.

6454 Field Theory

REFER ALSO TO CITATION(S) 49877, 49891, 49895, 49897, 49898, 49907, 49992, 49994

49908 (BNL—41448) The effects of fermions on lattice gauge theories with scalars. Lee, I-Hsiu. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 22p. (CONF-8805175—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014287/JAW.

From Lattice Higgs workshop; Tallahassee, FL, USA (16 May 1988).

The effects of fermions on the gauge-Higgs systems are investigated in the context of an SU(2) lattice gauge theory with scalar and fermion fields. The results from analytic studies and numerical simulations, with quenched and dynamical fermions, are presented. Some physical implications are discussed. 19 refs., 8 figs.

49909 (BNL—41495) Chiral gauge theory on a lattice: Are anomalous gauge theories renormalizable?. Aoki, S. (Brookhaven National Lab., Upton, NY (USA)). Jun 1988. Contract AC02-76CH00016. 10p. (CONF-8805175—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014288/JAW.

From Lattice Higgs workshop; Tallahassee, FL, USA (16 May 1988).

We discuss the quantization of chiral gauge theories by lattice regularization, carefully treating the effects of the chiral anomaly. We derive a chiral gauge invariant lattice fermion action from a chiral gauge variant Wilson fermion action without changing its partition function. By lattice power counting for this formula we show that anomalous gauge theories as well as anomaly-free gauge theories are renormalizable even in 4-dimensions. Some applications and implications of this result and problems therein are discussed. 16 refs.

49910 (BNL—41498) Standard model parameters and the search for new physics. Marciano, W.J. (Brookhaven National Lab., Upton, NY (USA)). Apr 1988. Contract AC02-76CH00016. 69p. (CONF-8707141—6). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015200/JAW.

From Theoretical advanced summer institute; Santa Fe, NM, USA (6 Jul 1987).

In these lectures, my aim is to present an up-to-date status report on the standard model and some key tests of electroweak unification. Within that context, I also discuss how and where hints of new physics may emerge. To accomplish those goals, I have organized my presentation as follows: I discuss the standard model parameters with particular emphasis on the gauge coupling constants and vector boson masses. Examples of new physics appendages are also briefly commented on. In addition, because these lectures are intended for students and thus somewhat pedagogical, I have included an appendix on dimensional regularization and a simple computational example that employs that technique. Next, I focus on weak charged current phenomenology. Precision tests of the standard model are described and up-to-date values for the Cabibbo-Kobayashi-Maskawa (CKM) mixing matrix parameters are presented. Constraints implied by those tests for a 4th generation, supersymmetry, extra Z{prime} bosons, and compositeness are also discussed. I discuss weak neutral current phenomenology and the extraction of sin{sup 2} {theta}{sub W} from experiment. The results presented there are based on a recently completed global analysis of all existing data. I have chosen to concentrate that discussion on radiative corrections, the effect of a heavy top quark mass, and implications for grand unified theories (GUTS). The potential for further experimental progress is also commented on. I depart from the narrowest version of the standard model and discuss effects of neutrino masses and mixings. I have chosen to concentrate on oscillations, the Mikheyev-Smirnov- Wolfenstein (MSW) effect, and electromagnetic properties of neutrinos. On the latter topic, I will describe some recent work on resonant spin-flavor precession. Finally, I conclude with a prospectus on hopes for the future. 76 refs.

49911 (CBPF-NF—026/87) On chiral symmetry and the pion-nucleon interaction in the skyrme model. Mignaco, J.A.; Wulck, S. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703955/JAW.

The skyrme model realizes spontaneous chiral symmetry breaking in the Goldstone mode. This raises questions concerning the meaning of numerical results displayed in recent "phenomenological" applications.

49912 (CBPF-NF—068/87) Asymptotic behaviour of physical amplitudes in a finite field theory. Helayel Neto, J.A.; Rajpoot, S.; Smith, A.W. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703962/JAW.

Using the N=4 super-Yang-Mills theory softly broken by supersymmetric N=1 mass terms for matter superfields, we compute the one-loop chiral + chiral -> antichiral + antichiral scattering amplitude directly in superspace. By suitable choices of the mass parameters, on can endow the model with a hierarchy of light and heavy particles, and the decoupling of the heavy sector from light-light physical amplitude is studied. We also analyze the high-energy limit of the cross-section for a two physical scalar scattering and find a (logs) behaviour, which then respects the Froissart bound.

49913 (CSIR-TWISK-TR—555) Nucleon as a color-magnetic soliton. Greben, J.M. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Research Inst. for Mathematical Sciences). Sep 1987. 36p. National Research Institute for Mathematical Sciences, P O Box 395, Pretoria, 0001, South Africa.

The QCD equations of motion for the nucleon are solved self-consistently by using an approximate semi-classical ansatz for the gluon field. This ansatz is suggested by the perturbative solution of the gluon equation of motion, with the nucleon being described in terms of three 1S-valence quarks. The self-coupling gluon terms do not affect the zeroth component of the gluon field, but have a profound effect on the spatialor magnetic components. A non-perturbative color-magnetic vacuum solution is found which can be connected to the perturbative vacuum by means of the quark-gluon interaction. The nucleon then emerges as a non-topological color-magnetic soliton. All solutions of the quark Dirac equation share the property of spatial confinement. Despite this confinement property, the spectrum of quark solutions is not (yet) discrete. The energy of the quark state can be chosen to reproduce the average nucleon-delta mass. Properties of the nucleon are calculated and presented for two values of the strong coupling constant.

49914 (DOE/ER/25009—605) Lattice gauge theory on the hypercube. Apostolakis, J.; Baillie, C.; Ding, Hong-Qiang; Flower, J. (California Inst. of Tech., Pasadena (USA)). 1988. Contract FG03-85ER25009. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015004/JAW.

Lattice gauge theory, an extremely computationally intensive problem, has been run successfully on hypercubes for a number of years. Herein we give a flavor of this work, discussing both the physics and the computing behind it. 19 refs., 5 figs., 27 tabs.

49915 (DOE/ER/40272—58) Lectures on string theory. Thorn, C.B. (Florida Univ., Gainesville (USA). Dept. of Physics). 1988. Contract FG05-86ER40272. 41p. (UFTP—88-7; CONF-8804173—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014736/JAW.

From Spring school on superstrings; Trieste, Italy (1 Apr 1988).

Several topics are discussed in string theory presented as three lectures to the Spring School on Superstrings at the ICTP at Trieste, Italy, in April, 1988. The first lecture is devoted to some general aspects of conformal invariance and duality. The second sketches methods for carrying out perturbative calculations in string field theory. The final lecture presents an alternative lattice

approach to a nonperturbative formulation of the sum over world surfaces. 35 refs., 12 figs.

49916 (DOE/ER/45342—1) Research in two dimensional critical phenomena and conformal field theory: Progress report, December 1, 1987--November 30, 1988. Friedan, D.; Shenker, S. (Chicago Univ., IL (USA)). Aug 1988. Contract FG02-88ER45342. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014913/JAW.

This progress report discusses progress in modular geometrys current algebra and conformal discrete series, and RG flow in the N = 1 discrete series.

49917 (IFT-P—03/88) Stochastic quantization and non-abelian gauge fields. Pimentel, B.M.; Suzuki, A.T.; Kolck, U.L. van. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica; Instituto de Fisica Teorica, Sao Paulo (Brazil); Texas Univ., Austin (USA). Dept. of Physics). (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1988. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703969/JAW.

Non-abelian gauge fields are considered in the framework of Stochastic Quantization. Its implementation does not reproduce known results for PI/sup ab//sub μν/ and <F/sub μν/ F/sub rhoσ/>except when a BRST invariant action is taken right from the beginning.

49918 (IFT-P—05/88) Analytic stochastic regularization: gauge and supersymmetry theories. Abdalla, M.C.B. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703972/JAW.

Analytic stochastic regularization for gauge and supersymmetric theories is considered. Gauge invariance in spinor and scalar QCD is verified to brak fown by an explicit one loop computation of the two, theree and four point vertex function of the gluon field. As a result, non gauge invariant counterterms must be added. However, in the supersymmetric multiplets there is a cancellation rendering the counterterms gauge invariant. The calculation is considered at one loop order.

49919 (IFT-P—17/87) Comments on stochastic quantization and regularization of gauge theories. Pimentel, B.M.; Kolck, V. von. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica). (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1987. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703974/JAW.

We discuss some aspects of stochastic quantization of gauge theories in the spirit of Parisi and Wu. We show that it is not compatible with dimensional regularization umless we suppress the noise associated with ciclic variables.

49920 (IFT-T—02/85) Dirac - Kaehler formalism and the Yang-Mills model with Supersymmetry. Goto, M. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1985. 281p. (In Portuguese). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88703975/JAW.

It is used the differential Dirac-Kahler's formalism for transposing supersymmetric models for the lattice. Such a formalism has shown itself extremely useful for these purposes because there exists a complete mathematical duality in its versions in the continuum and in the lattice. This work treats specifically the Yang-Mills, model with extended supersymmetry N = 2 in the adjoint representation; the procedure which is adopted here consists in to rewrite the essential of the model in question in the new language, first in the continuum, getting it adequate for the lattice, because it is from the property of the supercharges Q/sup 2/ = H that the lattice supersymmetric Hamiltonian will be obtained. By the way, it was constructed a lattice gauge theory within the formalism of Dirac-Kahler, it is almost a natural consequence of the adopted definitions for the lattice gauge transformations of the fields in the adjoint representation and of the two types of covariant derivatives which are necessary in the lattice. In order to carry out some calculations, it was put emphasis on the matrix representation of the Dirac-Kahler's formalism, it was also extended to a lattice.

49921 (IFUSP-P—642) Factorizable S-matrix for SO(D)/SO(2) x SO(D-2) non-linear σ models with fermions. Abdalla, E.; Lima-Santos, A. (Sao Paulo Univ. (Brazil). Inst. de Fisica; UNESP, Rio Claro (Brazil). Dept. de Fisica). (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1987. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703978/JAW.

We compute the exact S matrix for the non-linear sigma model with symmetry SO(D)/SO(2) x SO(d-2) coupled to fermions in a minimal or supersymmetric way. The model has some relevance in string theory with non-zero external curvature.

49922 (IFUSP-P—655) Analytic stochastic regularization in QCD and its supersymmetric extension. Abdalla, E.; Vianna, R.L. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Aug 1987. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703981/JAW.

We outline some features of stochastic quantization and regularization of fermionic fields with applications to spinor QCD, showing the appearence of a non-gauge invariant counterterm. We also show that non-invariant terms cancel in supersymmetric multiplets.

49923 (IFUSP-P—672) Analytic stochastic regularization in fermionic gauge theories. Abdalla, E.; Viana, R.L. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Nov 1987. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703987/JAW.

We analyse the influence of the Analytic Stochastic Regularization method in gauge symmetry, evaluating the 1-loop photon propagator correction for spinor QED. Consequences in the non-abelian case are discussed.

49924 (IFUSP-P—681) Surface tension in field theory at finite temperature: semiclassical fermionic plus bosonic contributions. Bazeia Filho, D.; Eboli, O.J.P.; Marques, G.C.; Silva, A.J. da. (Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica; UNESP, Rio Claro (Brazil)). (Sao Paulo Univ. (Brazil). Inst. de Fisica). Dec 1987. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703993/JAW.

The temperature dependent surface tension for a model involving a scalar field coupled to a fermionic field is computed within the one loop approximation. The fermionic and bosonic contribution have been computed in this approximation by evaluating explicitly the determinants in the presence of a domain wall.

49925 (IFUSP-P—685) Nonperturbative effects in the S matrix of the non-linear sigma model. Brunelli, J.C.; Gomes, M. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jan 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703996/JAW.

The factorization of nonperturbative effects in the S matrix of the non-linear sigma model is investigated. It is proved that, in each order of 1/N, the S matrix amplitudes can be written as a series in power of a dinamically generated mass times a convergent perturbative series.

49926 (IFUSP-P—686) Remarks on non compact sigma models. Brunini, S.A.; Gomes, M.; Silva, A.J. da. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jan 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703997/JAW.

O(N,1) noncompact sigma models quantized in an indefinite metric space. In two dimensions, by a direct computation the existence of a positive metric subspace where the S matrix is unitary. Is proved the properties of the model as function of the temperature are investigated in various space time dimensions.

49927 (INIS-BR—1212) Wall deffects in field theories at finite temperature. Bazeia Filho, D. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1985. 174p. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704004/JAW.

We discuss the effect of restauration of simmetry in field theories at finite temperature and its relation with wall deffects which appear as consequence of the instability of the constant field configuration. (M.W.O.).

49928 **(INIS-BR—1217) Functional expansion for evolution operators in a system of many fermions with many conditions.** Barrios, S.C. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1985. 61p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704009/JAW.

We present a mean field expansion for many body system, using integral functionals. The problem is formulated as a initial conditions one and it is studied the effective dynamics of the body density with given initial conditions. (M.W.O.).

49929 **(INIS-BR—1220) Axions.** Rosenfeld, R. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1985. 116p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88704012/JAW.

The Peccei-Quinn symmetry is a possible solution to the strong C.P. violation problem resulting from instantons contributions. It is the objective of this dissertation to study models which incorporate the Paccei-Ouinn symmetry as well as its consequences, for instance, the exiatence of a Goldstone pseudoboson named axion and the appearence of topologically satble structures generated at the spontaneous breakdown of the Peccei-Quinn symmetry. We also study the interchanged between axion models and Cosmology, particularly the influence of axions on the process of galsxy formation.

49930 **(OUP—88-03) External field approximation of quantum electrodynamics.** Kolsrud, M. (Oslo Univ. (Norway). Fysisk Inst.). Apr 1988. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754750/JAW.

The quantized field description of particles interacting only with a given unquantized (i.e. external) field is related in a simple way to the one-particle s matrix. Here s is based upon solutions of a one-particle wave equation, without any initial conditions. Thus in the relativistic case, s also acts upon unphysical "electron" states of negative energies. A factorization of s leads to simple exact expressions for QED's transition amplitudes for certain electron and/or positron processes (without photons). The formulas involve one-particle matrices, which are given by non-linear equations. The connection between Feynman's general non-unitary s/sup F/ matrix and the unitary Dirac s matrix is found. A "radiation interaction picture" is introduced, and a first order example is given.

49931 **(RRK—88-7) Off-shell amplitude in Witten's bosonic string field theory.** Sakai, Kenji. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Feb 1988. 31p. NTIS (US Sales Only), PC A03/MF A01; GPO Dep. Order Number DE88754575/JAW.

The off-shell amplitudes are calculated in the Witten's bosonic string field theory. We use ordinary methods in the first quantization by extending the Giddings' approach to this theory.

49932 **(SI—86-17) Background field method in stochastic quantization.** Okano, K. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 7 - Physik). 1986. 27p. Also published in Nucl. Phys., B - Part. Phys. (20 Jul 1987) v. 289(1) p. 109-126.

The background field approach to non-Abelian gauge field theory in stochastic quantization is presented. We discuss on the bases of the Zwanziger type stochastic gauge fixing in which we need not introduce the Faddeev-Popov ghost field. We can choose the Zwanziger function, and resultingly the Langevin equation, to be manifestly covariant under the background gauge transformation. Due to the background gauge covariance, we can easily find a simple Ward identity by which the β-function calculation in stochastic quantization can be extremely simplified. We give the one loop result of the β-function which is equivalent to the normal one. We also give another β-function β/sub γ/, which will give the relation between the energy scale and the fictitious time scale.

49933 **(UCRL—99090) Loopspace general covariance in string field theory.** Klinkhamer, F.R. (Lawrence Livermore National Lab., CA (USA)). May 1988. Contract W-7405-ENG-48. 4p. (CONF-880539—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014170/JAW.

From International symposium on spacetime symmetries; College Park, MD, USA (24 May 1988).

The prime goal in string physics today is to discover the underlying symmetries and derive the theory from first principles. Here I report on recent work by J. Greensite and myself on how to make bosonic string field theory invariant under another enormous symmetry, namely loop-dependent general coordinate transformations. 8 refs.

49934 **(UWThPh—1988-12) Wilson loop exponentiation and temporal gauges.** Hueffel, H.; Landshoff, P.V. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik; Cambridge Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics). (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1988. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704068/JAW.

Using generalisations of the Mandelstam-Leibbrandt prescription for a Yang-Mills theory in temporal gauge, we perturbatively calculate the Wilson loop. We demonstrate that its required exponentiation does not occur. 18 refs., 2 figs.

49935 **(UWThPh—1988-15) Wess-Zumino terms and the geometry of the determinant line bundle.** Blau, M. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1988. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704070/JAW.

The determinant line bundle L of a family of Dirac operators coupled to Yang-Mills (YM) in any dimension is constructed from the corresponding Wess-Zumino (WZ) term. The equivalence between the algebraic and topological approaches to anomalies is established by straightforward computation. As a by-product the first Chern class of L is expressed through the WZ-term and the integrated anomaly is explicitly seen to play the role of a functional magnetic field on the gauge-orbit space. 15 refs.

65 PHYSICS II

REFER ALSO TO CITATION(S) 48714

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 49880, 49970, 49975

49936 **(LA-UR—88-1762) Development and benchmarking of higher energy neutron transport data libraries.** Arthur, E.D.; Young, P.G.; Perry, R.T.; Madland, D.G.; MacFarlane, R.E.; Little, R.C.; Bozoian, M.; LaBauve, R.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-8805171—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014473/JAW.

From International conference on nuclear data for science and technology; San Diego, CA, USA (30 May 1988).

Neutron cross-section evaluations covering the energy range from 10/sup {minus}11/ to 100 MeV have been prepared for several materials. The principal method used to generate this data base has employed statistical-preequilibrium nuclear models, sophisticated phase shift analyses, and R-matrix techniques. The library takes advantage of formats developed for Version 6 of the Evaluated Nuclear Data File, ENDF. Methods to efficiently utilize the ENDF/B-VI representation of this library in the MCNP Monte Carlo code have been developed. MCNP results using the new library have been compared with calculated results using codes or data based upon intranuclear cascade models. 7 refs., 8 figs.

49937 (LA-UR—88-2130) The status of nuclear data evaluations for Version VI of ENDF/B. Young, P.G. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 14p. (CONF-880911—13). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014410/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

A new version of the United States national evaluated nuclear data file, ENDF/B-VI, is nearing completion. Major emphasis is being placed on correcting some long-standing nuclear data problems that adversely affect applied calculations for fission and fusion reactors. This paper reviews some of the evaluation activities of most revelance for fission reactor applications, namely, those involving control, cooling, and shielding materials, structural elements, and the major actinides. Additionally, because of its impact on all the data, work on the Standards Data File for Version VI is also summarized.

49938 (LA-UR—88-2140) Delayed neutron spectra by decay group for fissioning systems from ^{227}Th through ^{255}Fm. England, T.R.; Brady, M.C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 14p. (CONF-880911—10). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014408/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

The quality and quantity of delayed neutron precursor data has greatly improved over the past approximately 15 years. Supplementation of the data with model calculations and the use of models to extend the number of precursors to 271 is now practical. These data, along with improved fission-product parameters, permit direct calculations of aggregate behavior for many fissioning nuclides. The results can even be approximated using a few (usually six) temporal groups. This paper summarizes an extensive four-year effort to provide a complete set of evaluated data and emphasizes its use to generate the temporal approximations; precursor data and group values are intended for inclusion in ENDF/B-VI. 19 refs., 8 figs., 1 tab.

49939 (LBL—25573) Summary of the Relativistic Heavy Ion Sessions. Harris, J.W. (Lawrence Berkeley Lab., CA (USA)). Jul 1988. Contract AC03-76SF00098. 7p. (CONF-8805142—17). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014664/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

This paper briefly discusses the topics covered in the relativistic heavy ion in sessions. The prime motivation for these investigations is the possibility of forming quark matter, therefore the formation of a quark-gluon plasma. Topics on suppression of J/{psi} production, th equation of state of nuclear matter, transverse energy distributions and two pion interferometry techniques are discussed. 38 refs. (LSP)

49940 Neutron cross sections: Volume 2, Neutron cross section curves. McLane, V.; Dunford, C.L.; Rose, P.F. San Diego, CA; Academic Press, Inc. (1988). 843p. NTIS, PC A99/MF A01. Contract AC02-76CH00016.

Data is presented only for total (i.e., integrated) reaction cross sections (and related fission parameters) as a function of incident-neutron energy. The energy range has been limited to 0.01 eV to 200 MeV in order to exclude crystalline and magnetic effects for slow neutrons and relativistic effects for high energy neutrons. Angular distributions and partial reaction cross sections to specific excited states are not included. However, isometric state production cross sections have been included for isometric states with a half-life $>$ 1 sec. Data which have been measured for a broad incident-neutron spectrum, e.g., Maxwellian are not included. A list of the reaction types included in this volume is given at the end of this section. Sums and ratios of specific reactions are not included (e.g., σ/sub n,np+n,d/ or ^{238}U σ/sub n,f//^{239}Pu σ/sub n,f/). A table of references to data for energies greater than 200 MeV is given in Appendix A. In this volume, the data have been grouped into sections corresponding to the element of the target nucleus in the neutron-induced reaction. These sections are ordered in increasing atomic number (Z). Within a section, graphical data are presented for the natural element followed by the isotopes of that element in order of increasing atomic mass (A). The bibliographic pages follow at the end of each section.

6512 Nuclear Properties And Reactions, A=1-5, Experimental

49941 (DOE/ER/40390—1) Experiments on the nuclear interactions of pions and electrons: Progress report. Minehart, R.C.; Ziock, K.O.H. (Virginia Univ., Charlottesville (USA). Dept. of Physics). Jul 1988. Contract FG05-88ER40390. 165p. NTIS, PC A08. Order Number DE88015420/JAW.

We have completed analysis of pion induced nuclear reactions on ^{3}He and have submitted a proposal to LAMPF for a new experiment to study pion absorption in ^{3}He and ^{4}He using an extensive scintillator time-of-flight system capable of detecting neutrons as well as charged particles. A portion of this system is being constructed at Virginia from funds provided by the Commonwealth of Virginia. We are analyzing data obtained last August at SIN on the search for admixtures of massive neutrinos in pion decay and have continued the search for fractionally charged particles. We are also fully involved in some major collaborations: the search for the decay $\mu^+ \rightarrow e^+ + \gamma$, and the study of anti-proton absorption in heavy nuclei. We were involved in three experiments during the last year on electron scattering, using the SLAC-NPAS facility for nuclear physics and the electron accelerator at SACLAY in France. Experiment NE-9 at SLAC was designed to measure separately the transverse and longitudinal cross sections for inclusive electron scattering in the QFS region. It was run in the late fall of 1987, and the data are now being analyzed. Experiment NE-8 measured the cross section for photo-disintegration of the deuteron in the GeV range. It was run immediately after NE-9 at SLAC, and a partial analysis of the data is the basis for a paper that has been submitted for publication. We have done considerable design work on Experiment NE-16 at SLAC which is approved to measure the (e,e'p) reaction in ^{4}He. We have been collaborating on an experiment at SACLAY to study (e,e'p) in ^{16}O. In conjunction with the construction of the CEBAF accelerator, the fraction of our effort devoted to development of CEBAF experimental facilities has been increasing, with major emphasis on the program to build a Large Acceptance Spectrometer (LAS). 30 refs., 17 figs., 3 tabs.

49942 (UCRL—99015) Status report on the Livermore neutrino mass experiment using a frozen tritium source. Fackler, O.; Balke, B.; Mugge, M.; White, R.M. (Lawrence Livermore National Lab., CA (USA)). Mar 1988. Contract W-7405-ENG-48. 7p. (CONF-880369—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014137/JAW.

From International symposium on neutrino mass and related topics; Tokyo, Japan (16 Mar 1988).

We are performing an experiment to determine the electron neutrino mass with a precision of a few electron volts by measuring the shape of the tritium beta-decay energy distribution near the endpoint of the spectrum. Key features of the experiment are a high-activity frozen tritium source and an electrostatic spectrometer with a 2 eV resolution. The status of our experiment is discussed.

49943 Measurements of transverse quasielastic electron scattering from the deuteron at high momentum transfers. Arnold, R.G.; Benton, D.; Bosted, P.; Clogher, L.; DeChambrier, G.; Katramatou, A.T.; Lambert, J.; Lung, A.; Petratos, G.G.; Rahbar, A. (The American University, Washington, DC 20016). *Physical Review Letters;* **61**: No. 7, 806-809(15 Aug 1988).

Cross sections for 180° inelastic electron scattering from deuterium were measured from breakup threshold to beyond the quasielastic peak for incident-beam energies of 0.843, 1.020, 1.189, and 1.281 GeV, corresponding to $0.75 \leq Q^2 \leq 2.57$ (GeV/c)^2. The data are in reasonable agreement with nonrelativistic models that include final-state interactions and meson-exchange currents. The scaling function F(y) for these data is generally in agreement with F(y) for forward-angle data at the same Q^2. Values of G/sub M//sup n/ de-

termined from the data are in good agreement with results from previous experiments.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

49944 **(DOE/ER/40314—2) Progress report on research in Nuclear Physics, August 1, 1987--July 31, 1988.** Kozub, R.L. (Tennessee Technological Univ., Cookeville (USA). Dept. of Physics). Jul 1988. Contract FG05-87ER40314. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015418/JAW.

This report contains papers on the following topics: Electromagnetic transitions in neutron-rich nuclei in the A≅40 region via reactions of ^{36}S with ^{9}Be and ^{7}Li; electromagnetic transitions in neutron-rich ^{40}Cl; and efficiency for counting a large source of gamma rays.

49945 **(IFUSP-P—684) Effect of α-transfer polarization potential in the /sup 24/Mg+/sup 16/O system.** Lichtenthaler Filho, R.; Lepine-Szily, A.; Villari, A.C.C.; Portezan Filho, O. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Dec 1987. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703995/JAW.

The effect of the dynamic α-transfer polarization potential on several channels of the system /sup 24/Mg + /sup 16/O has been calculated and compared to out experimental data and those of Paul and collaborators. The general agreement is good, indicating that the α-transfer coupling can have an important contribution to explain the back-angle anomalies observed in the elastic, inelastic and transfer channels.

49946 **(IFUSP-P—688) Potential "anomalies" in /sup 14/N+/sup 27/Al,/sup 28/Si and /sup 29/Si systems.** Crema, E.; Acquadro, J.C.; Liguori Neto, R.; Carlin Filho, N.; Coimbra, M.M. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jan 1988. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703998/JAW.

Seven elastic angular distributions and the fusion excitation functions for the /sup 14/N + /sup 27/AL, /sup 14/N + /sup 28/Si and /sup 14/N + /sup 29/Si systems with in the energy range 1.1<E/sub CM//V/sub B/<2.5 are measured. The experimental fusion cross sections were superestimated by the simple one-dimensional barrier penetration model, with a "frozen" nuclear proximity potential. Through an effective variation of barrier height, the energy dependent corrections necessary to fit the data are calculated these corrections showed an "anomalous" behaviour in the above-barrier energy region. The corresponding imaginary potential parts were then constructed through the use of dispersion relation.

49947 **(LA—11330-T) Small angle elastic scattering of protons off of spinless nuclei.** Ling, A.G. (Los Alamos National Lab., NM (USA)). Jul 1988. Contract W-7405-ENG-36. 244p. NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88015056/JAW.

Elastic differential cross sections and analyzing powers for 800 MeV protons incident on ^{12}C, ^{40}Ca, and ^{208}Pb in the momentum transfer range 20 MeV/c < q < 130 MeV/c have been measured. The data was taken with the High Resolution Spectrometer (HRS) at the Los Alamos Meson Physics Facility. Special delay-line drift chambers with dead regions for the beam to pass through them were used to obtain the data. Through the interference of the Coulomb and nuclear contributions to the differential cross section in the small angle region, the ratio of the real to imaginary part of the forward nuclear amplitude α/sub n/(0) = Ref/sub n/(0)/Imf/sub n/(0) is extracted. The importance of knowing this quantity at lower energies in order to study the differences between relativistic and non-relativistic scattering theories is discussed. 130 refs., 60 figs., 12 tabs.

49948 **Observations of hyperon-nucleus systems produced on /sup 12/C and ^{7}Li targets using the (K^-,π^+) reaction at 715 MeV/c.** Tang, L.; Hungerford, E.; Kishimoto, T.; Mayes, B.; Pinsky, L.; Bart, S.; Chrien, R.; Pile, P.; Sutter, R.; Barnes, P. (University of Houston, Houston, Texas 77004). *Physical Review [Section] C: Nuclear Physics;* **38**: No. 2, 846-853(Aug 1988).

The hypernuclear systems Σ^- +/sup 11/B and Σ^- + ^{6}He were produced by the (K^-,π^+) reaction on targets on /sup 12/C (graphite) and ^{7}Li using 715 MeV/c incident kaons. Spectra were measured at reaction angles of 4° and 12° to investigate the momentum transfer dependence. A decay detector surrounded the target to provide a decay mode tag. Data were analyzed with and without this tag. The resulting spectra for the /sup 12/C target are similar to previous results with the exception that the narrow structure reported in the stopped K^- experiments is not confirmed. The spectra do show enhancements over phase space near the thresholds of the Σ plus core hole states which are created when a proton in the target is converted into a Σ. The decay mode cut shows a correlation between sigma-lambda conversion and this structure. No evidence of narrow states in either hypernucleus is observed in either the tagged or untagged data.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

49949 **(MPI-PAE/Exp.El.—188) Production of π/sup 0/ mesons and charged hadrons in anti ν neon and ν neon charged current interactions.** Wittek, W.; Aderholz, M.; Hoffmann, E.; Katz, U.F.; Kern, J.; Schmitz, N.; Allport, P.; Armenise, N.; Calicchio, M.; Erriquez, O. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.); Oxford Univ. (UK). Dept. of Nuclear Physics; Bari Univ. (Italy). Dipt. di Fisica; Istituto Nazionale di Fisica Nucleare, Bari (Italy)). (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik; Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.); Oxford Univ. (UK). Dept. of Nuclear Physics; Istituto Nazionale di Fisica Nucleare, Bari (Italy); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires; Stockholm Univ. (Sweden). Inst. of Physics). Mar 1988. 47p. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik.

The average multiplicities of charged hadrons and of π/sup +/, π/sup -/ and π/sup 0/ mesons, produced in anti ν Ne and νNe charged current interactions in the forward and backward hemispheres of the W/sup +-/-nucleon center of mass system, are studied with data from BEBC. The dependence of the multiplicities on the hadronic mass (W) and on the laboratory rapidity (y/sub Lab/) and the energy fraction (z) of the pion is also investigated. Special care is taken to determine the π/sup 0/ multiplicity accurately. The ratio of average π multiplicities 2 <n/sub π0/>/[<n/sub π+/> + <n/sub π-/>] is consistent with 1. In the backward hemisphere <n/sub π0/> is positively correlated with the charged multiplicity. This correlation, as well as differences in multiplicities between (-)νNe and (-)νp, (-)νn scattering, is attributed to reinteractions inside the neon nucleus of the hadrons produced in the initial (-)ν interaction.

6515 Nuclear Properties And Reactions, A=39-58, Experimental

49950 **(ANL/NDM—106) Fast-neutron elastic scattering from elemental vanadium.** Smith, A.B.; Guenther, P.T.; Lawson, R.D. (Argonne National Lab., IL (USA)). Mar 1988. Contract W-31109-ENG-38. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013712/JAW.

Differential neutron elastic- and inelastic-scattering cross sections of vanadium were measured from 4.5 to 10 MeV. These results were combined with previous 1.5 to 4.0 MeV data from this laboratory, the 11.1 MeV elastic-scattering results obtained at Ohio University, and the reported neutron total cross sections to energies

of ~20.0 MeV, to form a data base which was interpreted in terms of the spherical optical-statistical model. A fit to the data was achieved by making both the strengths and geometries of the optical-model potential energy dependent. This energy dependence was large below ~6.0 MeV. Above ~6.0 MeV the energy dependencies are smaller, and similar to those characteristic of global models. Using the dispersion relationship and the method of moments, the optical-model potential energy deduced from 0.0 to 11.1 MeV neutron-scattering data was extrapolated to higher energies and to the bound-state regime. This extrapolation leads to predicted neutron total cross sections that are within 3% of the experimental values throughout the energy range 0.0 to 20.0 MeV. Furthermore, the values of the volume-integral-per-nucleon of the real potential are in excellent agreement with those needed to reproduce the observed binding energies of particle- and hole-states. The latter gives clear evidence of the Fermi surface anomaly. Using only the 0.0 to 11.1 MeV data, the predicted E < O behavior of the strength and radius of the real shell-model Woods-Saxon potential are somewhat different from those obtained by Mahaux and Sartor in their analysis of nuclei near closed shells. 61 refs., 9 figs., 2 tabs.

49951 (CONF-8806167—2) Transfer reactions for the ^{50}Ti + ^{90}Zr system below the coulomb barrier. Kim, H.J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015552/JAW.

From Symposium on heavy ion interactions around the Coulomb Barrier; Padova, Italy (1 Jun 1988).

Experimentally observed enhancements of fusion cross sections are often attributed to result from coupling interactions between fusion and transfer channels. Existing experimental results indicate that large fusion enhancement generally goes with large neutron-transfer cross section and thus supports this attribute, but observations of more specific relations between these quasielastic channels have not yet been reported. Here we present some experimental results that pertain to fusion-transfer coupling interactions. 21 refs., 6 figs.

49952 (DOE/ER/05172—T1) Nuclear chemistry progress report: [August 1, 1979--July 31, 1980]. Viola, V.E. Jr.; Mignerey, A.C.; Breuer, H. (Maryland Univ., College Park (USA)). Aug 1980. Contract AS05-76ER05172. 67p. NTIS, PC A04. Order Number DE88015811/JAW.

This report contains papers on the following topics: studies of damped collisions induced by very heavy ions; reactions induced by complex projectiles above 10 MeV/u and astrophysics.

49953 (DOE/ER/05172—T2) [Studies of heavy-ion induced reactions]: Annual progress report. Mignerey, A.C. (Maryland Univ., College Park (USA). Dept. of Chemistry). Sep 1983. Contract AS05-76ER05172. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015810/JAW.

This report contains papers on the following topics: charge distributions in ^{56}Fe-induced reactions at 14.6 MeV/nucleon; quasielastic structure in the reaction ^{56}Fe + ^{56}Fe at 14.6 MeV/nucleon; and effects of particle evaporation in the N-Z plane.

49954 (KURRI-TR—296, pp 101-105) NMR on beta-emitting /sup 39/Ca produced through projectile fragmentation in high-energy heavy-ion collisions. Nojiri, Y.; Matsuta, K.; Minamizono, T. (Osaka Univ., Toyonaka (Japan). Faculty of Science). Nov 1987. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88900377/JAW. (CONF-8707148—).

From 1. KUR symposium on hyperfine interactions; Kyoto, Japan (20 Jul 1987).

49955 Systematic features in the structure of doubly odd nuclei around A≈80 mass region: Band structure in /sup 76/Rb. Garcia Bermudez, G.; Baktash, C.; Lister, C.J.; Cardona, M.A. (Department of Physics, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] C: Nuclear Physics;* **38**: No. 2, 1083-1086(Aug 1988).

Multiple-particle γ-ray coincidence techniques have been used to establish the high spin structure of /sup 76/Rb. Two ΔI = 1 bands were found built on the I/sup π/ = 1$^-$ ground state and on the I/sup π/ = (4$^+$) isomeric state at 316.8 keV energy. Systematic of positive parity bands seen in the Br-Kr-Rb isotones with N = 39 and 41 is discussed.

6516 Nuclear Properties And Reactions, A=59-89, Experimental

49956 (INIS-BR—1147-Vol.1, pp 201-209) Nuclear spectroscopic study of Se/sup 76/. Zamboni, C.B.; Saxena, R.N. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The directional angular correlation of coincidence {gamma}-transitions in Se/sup 76/ have been measured following the {beta}/sup -/ decay As/sup 75/(T1/2 = 26 hs) using a HPGe spectrometer. Measurements have been carried out for twenty four gama cascades resultings in the determination of multipole mixing ratios, {delta}(E2/M1), for seventeen {gamma}-transitions. Present results permitted definite assigments of spin and parity to the majority of levels in Se/sup 76/.

6517 Nuclear Properties And Reactions, A=90-149, Experimental

49957 (IFUSP-P—683) Level structure of /sup 101/Ru from the /sup 100/Ru (d,p) reaction. Duarte, J.L.M.; Horodynski-Matsushigue, L.B.; Borello-Lewin, T.; Dietzsch, O. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Dec 1987. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703994/JAW.

Energy levels of /sup 101/Ru have been studied by the /sup 100/Ru(d,p) /sup 101/Ru reaction at an incident deuteron energy of 12 MeV. Outgoing particles were momentum analyzed by a magnetic soectrograph and detected in nuclear emulsion plates with an energy resolution of 7.5 KeV. A total of 68 levels up to 3.2 MeV excitation energy was identified, about two thirds of them reported for the first time. Experimental angular distributions were compared to DWBA predictions and reduced spectroscopic factors obtained. The total l = 2 and about 75% of l = 0,4 and 5 spectroscopic strenths were located. Attention is drawn to transitions to low-lying states in /sup 101/Ru (below E/sub exc/ = 0.75 MeV) with L = 3 and l= 1 character.

49958 Production of pions and light fragments in 0.8A GeV La+La collisions. Hayashi, S.; Miake, Y.; Nagae, T.; Nagamiya, S.; Hamagaki, H.; Hashimoto, O.; Shida, Y.; Tanihata, I.; Kimura, K.; Yamakawa, O.; and others. (Department of Physics, Faculty of Science, University of Tokyo, Hongo, Bunkyo-ku, Tokyo 113, Japan). *Physical Review [Section] C: Nuclear Physics;* **38**: No. 3, 1229-1241(Sep 1988).

The spectra of pions and light fragments at laboratory angles from 10° to 89° were measured in 0.8A GeV La+La collisions. Event multiplicity was also measured to select central collisions. For inclusive data, the slope of the pion spectrum at θ/sub c.m./ = 90° for La+La is as steep as that for Ar+KCl while the slope of the proton spectrum at θ/sub c.m./ = 90° becomes less steep with increasing mass number of the colliding nuclei. Furthermore, the π$^-$ yield is about half of the geometrical estimate while total nuclear charge yield agrees well. Since the yield ratio of π$^-$ to total nuclear charge at θ/sub c.m./ = 90° is significantly larger for high multiplicity events than for inclusive data, it appears that pion absorption by spectator nucleons is important. An azimuthal correlation of charged particle emission was also observed, which is consistent with collective flow of nuclear matter. The coalescence relation between protons and composite fragments holds for inclusive data in La+La collisions.

6518 Nuclear Properties And Reactions, A=150-189, Experimental

49959 Population of high spin states by quasi-elastic and deep inelastic collisions. Takai, H.; Knott, C.N.; Winchell, D.F.; Saladin, J.X.; Kaplan, M.S.; de Faro, L.; Aryaeinejad, R.; Blue, R.A.; Ronningen, R.M.; Morrissey, D.J.; and others. (Department of Physics, University of Pittsburgh, Pittsburgh, Pennsylvania 15260). *Physical Review [Section] C: Nuclear Physics;* 38: No. 3, 1247-1261(Sep 1988).

The feasibility of populating high spin states using reactions induced by a 10 MeV/nucleon /sup 22/Ne beam on /sup 170/Er was studied. The experiment was carried out using a multidetector array for high resolution γ-ray spectroscopy, a 14 element sum-multiplicity spectrometer and six ΔE-E telescopes. Detailed information was obtained concerning the reaction mechanisms associated with various reaction channels. Deep inelastic collisions are shown to be a promising tool for high spin spectroscopy in regions of the chart of nuclides which are not accessible by other reactions.

49960 Beta decay of /sup 154/Lu and /sup 154/Yb. Vierinen, K.S.; Shihab-Eldin, A.A.; Nitschke, J.M.; Wilmarth, P.A.; Chasteler, R.M.; Firestone, R.B.; Toth, K.S. (Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review [Section] C: Nuclear Physics;* 38: No. 3, 1509-1512(Sep 1988).

Using mass-separated sources, the β-decay properties of /sup 154/Lu and /sup 154/Yb were investigated. Limits of /sup 154/Lu decay to the first 8^+ and 6^+ levels in /sup 154/Yb suggest a 7^+ spin for the odd-odd parent; also delayed proton emission and an indication of delayed α-particle emission were observed to follow /sup 154/Lu β decay. The β-decay branch of the α-emitting nucleus / sup 154/Yb was identified for the first time by the observation of one intense 133.2-keV γ ray. This transition deexcites a 1^+ 133.2-keV level in /sup 154/Tm which is fed by an allowed $0^+ \rightarrow 1^+$ β transition with a logft value of 3.6 +- 0.3.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

49961 (DOE/OR/00033—T408) Decay of mass-separted ^{195}Bi to levels in ^{195}Pb; collinear laser spectroscopy on mass-separated neutron-deficient lead isotopes. Griffin, J.C. (Oak Ridge Associated Universities, Inc., TN (USA); Georgia Inst. of Tech., Atlanta (USA)). Jun 1987. Contract AC05-76OR00033. 124p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88015641/JAW.

The radioactive decay of ^{195}Bi to ^{195}Pb has been studied with mass-separated sources from the UNISOR facility. Time-sequenced spectra of γ-rays, x-rays, and conversion electrons have been obtained, together with γ-γ-t, γ-x-t, e/sup {minus}/-γ-t, and e/sup {minus}/-x-t coincidence data. From this information, a decay scheme has been constructed, consisting of 26 excited states and 34 transitions. E0 transitions, strongly indicative of shape coexistence, have been found to de-excite positive-parity levels at 1125.8 keV and 1177.0 keV above the the $13/2^+$ isomeric level. The ground-state decay energy is deduced to be Q/sub EC/ = 4980+-$_{560}^{650}$ keV from a γ-gated K/β^+ ratio. The collinear laser/fast ion (atom) beam technique has been adapted and applied at the UNISOR laser facility for isotope shift measurements on mass-separated neutron-deficient Pb isotopes. The system has been used for isotope shift measurements on stable /sup 204,206,207,208/Pb, as well as the neutron-deficient isotope, ^{196}Pb, in an on-line experiment. Changes in the mean-square change radius of the nucleus ($\delta\langle r^2\rangle$) have been extracted from the measured isotope shifts. The overall system sensitivity has been determined to be approximately 2.0 {times} 10/sup {minus}3/ counts/Pb atom. 82 refs., 18 figs., 10 tabs.

49962 (LA-UR—88-2475) Multifragmentation. Jacak, B.V. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-8806117—8). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014400/JAW.

From 3. international conference on nucleus nucleus collisions; Saint-Malo, France (6 Jun 1988).

Results from the large solid angle measurement of multifragmentation in heavy ion collisions are presented. The impact parameter and bombarding energy dependence of the mechanism are discussed. Studies of collective flow effects and relative velocity between fragments are used to determine the timescale of the fragmentation. 29 refs., 5 figs.

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

49963 (CONF-880911—1) Current plutonium cross-section evaluations in the resolved resonance region. Derrien, H.; de Saussure, G. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006416/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

The representation of the fissile nuclei cross section in the resonance region in the evaluated data files is far from being satisfactory. Most evaluations need updating. For example, the ENDF/B-V evaluation for ^{239}Pu was taken from an evaluation done in 1973 for ENDF/B-III and still uses the single level and multilevel Breit-Wigner formalisms to represent the cross sections. The strong level-level interference effects in the fission channels cannot be represented in the formalism and a so-called smooth File 3 is needed to obtain agreement with measured cross sections. This File 3 creates complications in the calculation of Doppler broadened cross sections. Large improvements can now be obtained by taking advantage of: new measurements, mainly from ORNL, with higher accuracy or much better resolution than previously available data, new resonance analysis codes, particularly SAMMY[5] which uses sophisticated R-matrix formalisms for an accurate representation of the cross sections for all reaction channels, and Bayesian methods for a consistent analysis of several sets of experimental data; improvement of the processing codes for group cross-section calculations, allowing the cross sections to be calculated with the same R-matrix formulations than those used in the resonance analysis codes. 19 refs., 2 figs., 2 tabs.

49964 (CONF-880911—2) A new resonance-region evaluation of neutron cross sections for U-235. de Saussure, G.; Leal, L.C.; Perez, R.B.; Larson, N.M.; Moore, M.S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006412/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

This paper describes a multilevel resonance analysis of the ^{235}U neutron cross sections in the resolved resonance energy region. 15 refs., 3 figs., 2 tabs.

49965 (CONF-880911—3) On the unresolved resonance region representation of neutron induced cross sections. Perez, R.B.; de Saussure, G.; Leal, L.C.; Macklin, R.L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88006406/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

The accurate representation of neutron cross sections in the unresolved resonance region is of interest for the calculation of the Doppler coefficient of reactivity and self-shielded group cross -section sets for fast reactors. Customarily, the cross sections in the unresolved resonance region are described on the basis of the statistical theory of nuclear reactions, by specifying average values and distribution functions for the resonance parameters. Resonance self-shielding factors can then be calculated by the appropriate statistical techniques. In this work we review the unresolved resonance region formalism in the light of the availability of new high-energy resolution measurements. 8 refs., 3 figs., 2 tabs.

49966 (INIS-BR—1147-Vol.1, pp 241-249) **Photofission of /sup 237/Np in the energy range 18-60 MeV.** Arruda Neto, J.D.T. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The bremsstrahlung-induced fission cross section {sigma}/sub B,f/ of /sup 237/Np was measured with the University of Sao Paulo Electron Linear Accelerator, in the energy range 18-60 MeV. From the experimentally determined {sigma}/sub B,f/ we deduced for the first time, the photofission cross section of /sup 237/Np in this same energy range, by making use of both the Levinger's Modified Quasi-Deuteron Model to describe the photoexcitation mechanism, and the statistical decay model for the fission probability calculation.

49967 **(LA-UR—88-626) Delayed neutron spectra decay group for fissioning systems from ^{227}Th through ^{255}Fm.** England, T.R.; Brady, M.C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36;AC05-84OR21400. 9p. (CONF-880911—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88006459/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

Most applications of delayed neutrons use an approximate temporal group representation of measured aggregate data. Such data have been limited to the few fissioning nuclides that have aggregate measurements, and even these have inadequate or no spectral measurements. Improvements in the experimental techniques of isotope separation and neutron spectroscopy have made the study of delayed neutron emission from individual precursor nuclides more practical and productive over the past fifteen or so years. The quantity and quality of the delayed neutron emission probabilities and particularly the neutron emission spectra for the individual nuclides have been greatly improved. This paper will briefly review a recently completed evaluation of precursor data that comprises the largest single set of such data to date, and will also describe how the precursor data has been used to produced delayed neutron yields, halflives, and spectra in the classical six-group representation for 43 fissioning systems from ^{227}Th to ^{255}Fm. Comments and observations made concerning the use of more than six time groups will also be included. The application of the data in both its explicit and reduced (six temporal group representation) forms in the point reactor kinetics equations will also be discussed. Results from beta-effective calculations in a simple Godiva-type system will be presented, but the paper will concentrate on the data base and its few-group representations. 17 refs., 1 fig., 1 tab.

49968 **(LA-UR—88-1896) A study of the ^{235}U(n,f) cross section in the 3 to 30 MeV energy region.** Carlson, A.D.; Wasson, O.A.; Lisowski, P.W.; Ullmann, J.L.; Hill, N.W. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-880546—29). NTIS, PC A02. Order Number DE88014450/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

The ^{235}U(n,f) cross section is often considered the most favorable of the neutron cross section standards. Above a few MeV, however, the uncertainties are still unacceptably high, except for the 14 MeV region. In an effort to improve the accuracy of this cross section, measurements have been initiated at the new target 4 facility at the Los Alamos National Laboratory (LANL) 800 MeV proton accelerator. This target provides an intense source of high energy neutrons at the 20 meter flight path used in the present study. The fission reaction rate is determined with a fast parallel plate ionization chamber designed at LANL while the neutron fluence is being measured with an annular proton recoil telescope whose properties were carefully studied earlier at the National Bureau of Standards (NBS). This detector provides satisfactory performance for neutron energies up to about 30 MeV. Possible use of this detector at higher neutron energies where the recoil proton range exceeds the solid state detector thickness is being investigated. The measurements provide the shape of the ^{235}U(n,f) cross section relative to the hydrogen scattering cross section. The data will be normalized to the very accurately known values at 14 MeV. Experimental tests, diagnostic studies and preliminary cross section determinations have been completed and will be reported. 7 refs., 5 figs., 1 tab.

49969 **Neutron-induced fission of the 26 min /sup 235/U isomer.** D'Eer, A.; Wagemans, C.; Neve de Mevergnies, M.; Goennenwein, F.; Geltenbort, P.; Moore, M.S.; Pauwels, J. (Nuclear Research Center SCK/CEN, B-2400 Mol, Belgium). *Physical Review [Section] C: Nuclear Physics;* **38**: No. 3, 1270-1276(Sep 1988).

We have measured the neutron-induced-fission cross section of the /sup 235/U isomer with cold and with thermal neutrons. Because of its short half-life (26 min), preparation of an adequate isomeric target is the major difficulty. A simple and easy-to-operate technique has been developed. The cross-section ratio of isomer to ground state is measured to be 1.61 +- 0.44 and 2.47 +- 0.45 for the cold and the thermal neutrons, respectively.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 49831, 49913, 49939, 49945, 50057, 50110

49970 **(ANL—88-22) Physics Division annual review, 1 April 1987--31 March 1988.** (Argonne National Lab., IL (USA)). Jun 1988. Contract W-31109-ENG-38. 336p. NTIS, PC A15/MF A01; 1; GPO Dep. Order Number DE88015573/JAW.

This paper contains a description of the research project at Argonne National Laboratory over the past year (4/11/87--3/31/88). The major sections of this report in nuclear physics are: research at ATLAS; operation and development of TLAS: medium-energy nuclear physics and weak interactions; and theoretical nuclei physics. The major sections in atomic physics are: high-resolution laser-rf spectroscopy with beams of atoms, molecules and ions; beam-foil research, ion-beam laser interactions, and collision dynamics of heavy ions; interactions of fast atomic and molecular ions with solid and gaseous target; theoretical atomic physics; atomic physics at ATLAS; atomic physics using a synchrotron light source; and molecular structures and dynamics from coulomb-explosion measurements. (LSP)

49971 **(BNL-NCS—52142) The program RADLST [Radiation Listing].** Burrows, T.W. (Brookhaven National Lab., Upton, NY (USA)). 29 Feb 1988. Contract AC02-76CH00016. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88016851/JAW.

The program RADLST (Radiation Listing) is designed to calculate the nuclear and atomic radiations associated with the radioactive decay of nuclei. It uses as its primary input nuclear decay data in the Evaluated Nuclear Structure Data File (ENSDF) format. The code is written in FORTRAN 77 and, with a few exceptions, is consistent with the ANSI standard. 65 refs.

49972 **(CBPF-NF—066/87) Most probable masses of isotopic distributions and systematics of photospallation yields.** Martins, J.B.; Di Napoli, V.; Aspetaki, C. (Rome Univ. (Italy)). (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703960/JAW.

A Z-dependence of the most probable mass number Amp for isotopic distributions of spallation residual is proposed. The modified five-parameter semi-empirical formula thus deduced seems to reproduce fairly well most of the experimental data of photo-spallation yields. (authors).

49973 **(CONF-880557—3) Stochastic Nuclear Reaction Theory: Breit-Wigner nuclear noise.** de Saussure, G.; Perez, R.B. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015547/JAW.

From NATO advanced research workshop on noise and nonlinear phenomena in nuclear systems; Valencia, Spain (23 May 1988).

The purpose of this paper is the application of various statistical tests for the detection of the intermediate structure, which lies

immersed in the Breit-Wigner "noise" arising from the superposition of many compound nucleus resonances. To this end, neutron capture cross sections are constructed by Monte-Carlo simulations of the compound nucleus, hence providing the "noise" component. In a second step intermediate structure is added to the Breit-Wigner noise. The performance of the statistical tests in detecting the intermediate structure is evaluated using mocked-up neutron cross sections as the statistical samples. Afterwards, the statistical tests are applied to actual nuclear cross section data. 10 refs., 1 fig., 2 tabs.

49974 **(CONF-880766—3) Nuclear orbiting.** Shapira, D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015564/JAW.

From 5. international conference on clustering aspects in nuclear and subnuclear systems; Kyoto, Japan (25 Jul 1988).

Nuclear orbiting following collisions between sd and p shell nuclei is discussed. The dependence of this process on the real and imaginary parts of the nucleus-nucleus potential is discussed, as well as the evolution of the dinucleus toward a fully equilibrated fused system. 26 refs., 15 figs.

49975 **(CONF-880896—1) Neutron flow between nuclei as the principal enhancement mechanism in heavy-ion subbarrier fusion.** Stelson, P.H. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015566/JAW.

From Symposium on heavy-ion reaction dynamics in tandem energy region; Hitachi, Japan (1 Aug 1988).

The observed enhanced cross sections for heavy-ion fusion are interpreted with a model in which the near barrier cross sections are dominated by neck formation initiated by neutron flow between the colliding nuclei. The collective properties of the colliding nuclei are then interpreted as a modulation of the thresholds for neck formation and dominate the cross sections in the region far below the barrier. 12 refs., 12 figs., 2 tabs.

49976 **(GSI—88-27(prepr.)) Dissipative fluid dynamics.** Morgenstern, B.; Noerenberg, W. (Technische Hochschule Darmstadt (Germany, F.R.)). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Technische Hochschule Darmstadt (Germany, F.R.)). May 1988. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754647/JAW.

With restriction to an irrotational velocity field, equations of motion for a nuclear fluid with dissipation are derived from the quantum-mechanical variational principle. Memory effects in the resulting Navier-Stokes-like equations ascribe elastoplasticity to the fluid whenever the intrinsic equilibration times are comparable to the collective time scale. The markovian limits yield the Euler equation, the Navier-Stokes equation and the fluid-dynamical equation for irrotational velocity fields.

49977 **(GSI—88-29(prepr.)) Effective Schroedinger equation for nuclear fluid dynamics.** Wu, J.; Feng, R.; Noerenberg, W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). May 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754649/JAW.

The equations of motion for a nuclear fluid are transformed into an effective single-particle Schroedinger equation with self-interactions. This transformation is particularly useful for numerical applications, because the Weizsaecker corrections which cause numerical instabilities in computations within the fluid-dynamical picture, are absorbed in the kinetic energy term of the effective Schroedinger equation. In applications to the motion and collision of nuclear slabs the numerical treatment of the nuclear fluid by the effective Schroedinger equation is proven to be stable and accurate.

49978 **(GSI—88-30(prepr.)) Missing charge problem in the longitudinal response and the importance of two particle - two hole states.** Jaenicke, J.; Schuck, P.; Hasse, R.W. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Inst. des Sciences Nucleaires). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). May 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754650/JAW.

By using semiclassical methods, 2p-2h states are included into the RPA solution of the longitudinal response function in the quasielastic peak region. Consistent use of the finite range Gogny force has been made. An important influence of 2p-2h states is found which quenches and broadens the strength distribution by about 10 to 20% in closer agreement with the experiment.

49979 **(IFUSP-P—671) Bound state solution of the Grassmannian nonlinear sigma model with fermions.** Abdalla, E.; Lima-Santos, A. (Sao Paulo Univ. (Brazil). Inst. de Fisica; UNESP, Rio Claro (Brazil). Dept. de Fisica). (Sao Paulo Univ. (Brazil). Inst. de Fisica). Nov 1987. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703986/JAW.

We construct the s matrix for bound state (gauge-invariant) scattering for nonlinear sigma models defined on the manifold SU(N)/S(U(p)x (lower casex)U(n-p)) with fermions. It is not possible to compute gauge non-singlet matrix elements. In the present language they are not submitted to sufficiently many constraints derived from higher conservation laws.

49980 **(IFUSP-P—674) Chaotic behaviour of the nuclear shell-model hamiltonian.** Dias, H.; Hussein, M.S.; Oliveira, N.A. de; Wildenthal, B.H. (Sao Paulo Univ. (Brazil). Inst. de Fisica; Drexel Univ., Philadephia, PA (USA). Dept. of Physics and Atmospheric Science). (Sao Paulo Univ. (Brazil). Inst. de Fisica). Nov 1987. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703989/JAW.

Large scale nuclear shell-model calculations for several nuclear systems are discussed. In particular, the statistical baheviour of the energy eigenvalues and eigenstates, are discussed. The chaotic behaviour of the NSMH is then shown to be quite useful in calculating the spreading width of the highly collective multipole giant resonances.

49981 **(INIS-BR—1218) Nuclear photoproduction of PI-mesons in intermediary.** Almeida, E.S. de. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1979. 173p. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704010/JAW.

We study a systematic method to describe PI-meson photoproduction in complex in the energy range (0,2-1 Gev), using the Monte Carlo Method. (M.W.O.).

49982 **(LA-UR—88-944) The 0^+ {minus} 1^+ A = 4 Λ-hypernuclei binding energy difference in an exact equation, separable potential calculation.** Gibson, B.F.; Lehman, D.R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 2p. (CONF-880938—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88007828/JAW.

From International symposium on mesons and light nuclei; Rez, Czechoslovakia (5 Sep 1988).

49983 **(LA-UR—88-1809) Instantaneous meson-exchange potentials on the light front.** Johnson, M.B. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-880688—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014462/JAW.

From Summer workshop of the continuous electron beam accelerator facility; Newport News, VA, USA (20 Jun 1988).

In this talk I will address the feasibility and desirability of building a theory of nuclei around instantaneous nucleon-nucleon potentials defined on the light front. 11 refs.

49984 **(LA-UR—88-2340) Recent improvements in the calculation of prompt fission neutron spectra: Preliminary results.** Madland, D.G.; LaBauve, R.J.; Nix, J.R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 12p. (CONF-8805174—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88014331/JAW.

From IAEA consultants' meeting on the physics of neutron emission in fission; Mito, Japan (24 May 1988).

Three tropics have been considered in the refinement and improvement of our original calculations of prompt fission neutron spectra. These are an improved calculation of the prompt fission neutron spectrum N(E) from the spontaneous fission of ^{252}Cf, a complete calculation of the prompt fission neutron spectrum matrix N(E,E/sub n/) from the neutron-induced fission of ^{235}U, at incident neutron energies ranging from 0 to 15 MeV, and an assessment of the scission neutron component of the prompt fission neutron spectrum. Preliminary results will be presented and compared with experimental measurements and an evaluation. A suggestion has been made for new integral cross-section measurements.

49985 **(LA-UR—88-2370) Calculated proton-induced thick-target radionuclide activation yields and neutron yield spectra for E/sub p/ ≦ 50 MeV, with comparisons to other calculations and measured data.** Wilson, W.B.; Arthur, E.D.; LaBauve, R.J.; Perry, R.T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-880546—32). NTIS, PC A02. Order Number DE88014333/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

Radionuclide production cross sections have been calculated with the GNASH code for protons below 50 MeV incident of on the stable nuclides of a range of elements common to accelerator materials. These elements include C, O, Ne, Al, Si, Fe, Co, Ni, Cu, and W. These data, augmented with limited measured data, have been used with the proton stopping cross-section data of Anderson and Ziegler to calculate thick-target yield values for the formation of a range of radionuclides in accelerator materials. Illustrative results are presented. GNASH calculations have also been made on a grid of proton energies below 50 MeV to produce differential cross sections describing angle-integrated neutron production spectra. The angular distribution systematics of Kalbach and Mann have been used to produce double-differential cross-section, which were used with the proton stopping data to produce anisotropic thick-target neutron yield spectra. Results are presented for 52-MeV protons on a thick target of Cu. Comparisons are made with results of HETC calculations, using cross sections from the intranuclear cascade plus evaporation model, and with thick-target neutron yield spectra measured by Nakamura, Fijii, and Shin. 15 refs., 3 figs., 1 tab.

49986 **(LA-UR—88-2507) Final state effects in inclusive quasielastic electron scattering from nuclei: Clues from quantum fluids.** Silver, R.N.; Clark, J.W. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-8806144—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014403/JAW.

From 5. international conference on nuclear reaction mechanisms; Villa Monastero, Italy (13 Jun 1988).

The impulse approximation (IA) predicts that momentum distributions, n{sub k}, in many-body systems should be measurable by inclusive quasielastic scattering at high energy and momentum (w,Q) transfer. The observations that the cross section appears to satisfy "Y-scaling" (i.e., is a function not of both w and Q of a single variable, Y) is usually taken as a signature of the IA. In nuclear physics, inelastic electron scattering at GeV energies should reveal the high momentum components of the nuclear wave function. In quantum fluids, neutron scattering at hundreds of MeV energies should measure the Bose condensate in superfluid {sup 4}He and the Fermi surface discontinuity and depletion of the Fermi sea in {sup 3}He. In molecular and condensed matter systems, X-ray Compton scattering at keV energies reveals electronic n{sub k}. Such experiments test many-body wave functions calculated by methods such as Green Function and Path Integral Monte Carlo, and Fermi Hypernetted Chain. However, an outstanding issue has been the corrections to the IA due to the scattering of the recoiling particle from neighboring particles, which are termed "final state effects" (FSE). The FSE should be especially important in nuclei and quantum fluids where the potentials have steeply repulsive cores. While there have been a variety of theories proposed for FSE, until now none has been adequately tested by experiment. Recently, the "hard core perturbation theory" (HCPT) for FSE in quantum fluids by Silver has been successfully compared to new neutron scattering measurements on {sup 4}He by P. E. Sokol and colleagues. In this paper, we shall discuss the lessons of this success for the extraction of n{sub k} in nuclei by inclusive "quasielastic electron-nucleus scattering" (QENS). 19 refs., 12 figs.

49987 **(SAND—88-1194C) Incipient spall, crack branching, and fragmentation statistics in the spall process.** Grady, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-880940—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88009587/JAW.

From 2. international conference on mechanical and physical behavior of materials under dynamic loading; Ajaccio, France (19 Sep 1988).

Energy based theories of spall fracture and fragmentation are examined. A concept of energy-limited and flaw-limited spall emerges naturally within one of these theories. Conditions favoring incipient spall and crack branching in the spall process are identified. The fragmentation are investigated. 16 refs., 2 figs.

49988 **(UCRL—97683) The nuclear structure of deformed odd-odd nuclei: Experimental and theoretical investigations.** Hoff, R.W.; Jain, A.K.; Sood, P.C.; Sheline, R.K. (Lawrence Livermore National Lab., CA (USA)). 6 Jun 1988. Contract W-7405-ENG-48. 9p. (CONF-880639—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013819/JAW.

From International conference on contemporary topics in nuclear structure physics; Cocoyoc, Mexico (9 Jun 1988).

Previous surveys of experimental level structure in deformed odd-odd nuclei have been updated with recent results for the lanthanide and actinide regions. The relative strengths of the effective neutron-proton interaction derived from these data are compared. The predictive power of a semi-empirical model for level structure in deformed odd-odd nuclei is demonstrated. Comparison is made with recent Hartree-Fock calculations of selected nuclei.

49989 **Pion-nucleus double charge exchange and the nuclear shell model.** Auerbach, N.; Gibbs, W.R.; Ginocchio, J.N.; Kaufmann, W.B. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] C: Nuclear Physics;* 38: No. 3, 1277-1296(Sep 1988).

The pion-nucleus double charge exchange reaction is studied with special emphasis on nuclear structure. The reaction mechanism and nuclear structure aspects of the process are separated using both the plane-wave and distorted-wave impulse approximations. Predictions are made employing both the seniority model and a full shell model (with a single active orbit). Transitions to the double analog state and to the ground state of the residual nucleus are computed. The seniority model yields particularly simple relations among double charge exchange cross sections for nuclei within the same shell. Limitations of the seniority model and of the plane-wave impulse approximation are discussed as well as extensions to the generalized seniority scheme. Applications of the foregoing ideas to single charge exchange are also presented.

49990 **Mesic retardation and the triton binding energy.** Brandenburg, R.A.; Chulick, G.S.; Machleidt, R.; Picklesimer, A.; Thaler, R.M. (Physics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 Department of Physics, University of Basel, Basel, Switzerland Physics Department, Case Western Reserve University, Cleveland, Ohio 44106 Department of Physics, University of California, Los Angeles, Los Angeles, California). *Physical Review [Section] C: Nuclear Physics;* 38: No. 3, 1397-1402(Sep 1988).

The relationship between the apparently successful result for the triton binding energy obtained from the static Bonn potentials

and the underlying meson theory is investigated. The triton binding is shown to be strongly dependent upon mesic retardation and associated explicit energy dependences in the meson theory of the nucleon-nucleon interaction. Because it is a much closer representation of the full interaction than are its energy-independent counterparts, the energy-dependent one-boson-exchange potential representation of the Bonn interaction is used to gauge the implications of the full interaction. This one-boson-exchange potential, with or without corrections to adapt it for use in conjunction with nonrelativistic (Schroedinger) three-body equations, predicts a triton binding of only ~6.7 MeV, as compared to a result of about 8.4 MeV obtained with the energy-independent potentials. This difference is traced to the combination of the explicit energy-dependence and the implicit energy dependence introduced through the tensor force, especially in the $^3S_1$ partial wave. This provides a new perspective on the success of the static Bonn potentials relative to other realistic potentials and relative to the meson-theoretic framework. Implications, especially with regard to the need for investigations of consistent three-body forces, are discussed.

49991 **Sharing of collective multipole strength in the nuclear particle-hole model.** Madsen, V.A.; Brown, V.R. (Physics Department, Oregon State University, Corvallis, Oregon 97331). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 3, 1428-1439(Sep 1988).

A procedure is given for defining explicitly the noncollective states of the degenerate schematic model for nuclear particle-hole configurations. The method is based on the view that the degenerate model is an approximation to the nondegenerate particle-hole model. In the collective-noncollective basis with a single force type, the separable particle-hole Tamm-Dancoff Hamiltonian matrix is transformed into one which is diagonal except for the row and column of the one collective state. The multipole strength of any noncollective state of the nondegenerate problem is given in perturbation theory in terms of the collective-noncollective matrix elements, which are expressed in terms of the parameters of the assumed separable multipole interaction. Application of the sharing formulas is made to Landau damping of the collective state due to mixing with the noncollective states. The relative contribution to the width due to the nondegeneracy and the nonseparable nature of the interaction are examined. Another application examines the random-phase-approximation energy distribution of isospin shared by the isoscalar and isovector collective states with the noncollective states over the giant quadrupole resonance region in /sup 118/ Sn.

49992 **Comment on "p-barp→Lambda-barΛ reaction in the one-gluon-exchange and the $^3P_0$ models".** Alberg, M.A.; Henley, E.M.; Wilets, L. (Department of Physics, Seattle University, Seattle, Washington 98122). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 3, 1506-1507(Sep 1988).

A number of recent papers have compared the $^3P_0$ and $^3S_1$ models for N-barN annihilation. We argue that a more consistent approach is to use both models together because they represent different aspects of quantum chromodynamics. In the approximation of the paper on which this Comment is based, our approach gives better agreement with data.

49993 **Medium energy γ rays in nuclear reactions.** Reffo, G.; Blann, M.; Remington, B.A. (Physics Department, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 3, 1190-1194(Sep 1988).

A model is formulated for the prediction of medium energy γ rays in light-ion-induced collisions. We assume a semidirect reaction whereby the giant dipole resonance is excited in the preequilibrium relaxation process. Detailed balance is used to invert experimental photon absorption cross sections to a γ-ray emission rate, and this emission rate is incorporated into the hybrid model for preequilibrium decay. Comparisons of calculated and experimental γ-ray spectra from 14 MeV neutron-induced reactions give reasonably good agreement, as do comparisons with 27 MeV ^{3}He- and α-induced reactions. An npy bremsstrahlung calculation underpredicts these same data by a large amount. Our findings are consistent with an interpretation that the giant dipole resonance collective excitation may be induced by single particle-hole transitions in the preequilibrium relaxation process, and may contribute to the high-energy tail of observed γ-ray emission spectra.

49994 **Higher-order pair-conversion peaks in heavy-ion collisions.** Carrier, D.; Krauss, L.M. (Department of Physics, Gibbs Laboratory, Yale University, New Haven, Connecticut 06511). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 3, 1225-1228(Sep 1988).

We analyze quantum electrodynamic pair creation from vibrating nuclear "quasimolecules" which may occur in collisions of heavy ions. We find that higher-order processes, which can be phenomenologically relevant for sufficiently long lived systems, can result in coincident narrow peaks even for subcritical systems. The Z dependence of the energy of the peaks can be much softer than that predicted for positrons from "sparking" of the vacuum. Our results may be relevant to peaks which have been observed at the Gesellschaft fuer Schwerionenforschung (GSI).

49995 **Overview of the 1986—1987 atomic mass predictions.** Haustein, P.E. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973). *Atomic Data and Nuclear Data Tables;* **39**: No. 2, 185-200(Jul 1988).

The need for a comprehensive update of earlier sets of atomic mass predictions is documented. A project that grew from this need and which resulted in the preparation of the 1986—1987 Atomic Mass Predictions is summarized. Ten sets of new mass predictions and expository text from a variety of types of mass models are combined with the latest evaluation of experimentally determined atomic masses. The methodology employed in constructing these mass predictions is outlined. The models are compared with regard to their reproduction of the experimental mass surface and their use of varying numbers of adjustable parameters. Plots are presented, for each set of predictions, of differences between model calculations and the measured masses. These plots may be used to estimate the reliability of the new mass predictions in unmeasured regions that border the experimetally known mass surface. copyright 1988 Academic Press, Inc.

49996 **Nuclear masses from unified macroscopic-microscopic model.** Moeller, P.; Nix, J.F. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Atomic Data and Nuclear Data Tables;* **39**: No. 2, 213-224(Jul 1988).

We calculate ground-state masses for 4678 nuclei ranging from ^{16}O to /sup 318/122 by means of an improved version of the macroscopic-microscopic model employed in our 1981 mass calculation, which uses a Yukawa-plus-exponential model for the macroscopic term and a folded-Yukawa single-particle potential as starting point for the microscopic term. Some of the new features now incorporated are a new model for the average pairing strength, the solution of the microscopic pairing equations by use of the Lipkin-Nogami method with approximate particle-number conservation, the use of experimental mass uncertainties in determining the model parameters, and an estimation of the theoretical error of the model by application of the maximum-likelihood method. Only five parameters are determined from least-squares fitting to the nuclear masses; the other constants in the model are taken from previous work with no adjustment. The resulting theoretical error in the calculated ground-state masses fo 1593 nuclei ranging from ^{16}O to ^{263}106 is 0.832 MeV. We also extend the calculation to some additional nuclei in the heavy and superheavy region that were not considered in 1981. The present calculation represents an interim report on a project in which we plan to make further improvements and extend the region of nuclei considered to the neutron and proton drip lines. copyright 1988 Academic Press, Inc.

49997 **Nuclear mass formula with a finite-range droplet model and a folded-Yukawa single-particle potential.** Moeller, P.; Myers, W.D.; Swiatecki, W.J.; Treiner, J. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Atomic Data and Nuclear Data Tables;* **39**: No. 2, 225-234(Jul 1988).

We calculate ground-state masses for 4678 nuclei ranging from ^{16}O to /sup 318/122 by use of a macroscopic-microscopic model, which incorporates several new features. For the macro-

scopic model we use the finite-range droplet model which we introduced in 1984. The microscopic contribution is taken from a calculation based on a folded-Yukawa single-particle potential. Some new features now incorporated are a new model for the average pairing strength and the solution of the microscopic pairing equations by use of the Lipkin-Nogami method with approximate particle number conservation. To estimate the parameters of the macroscopic model we use an approach that starts by defining the error of a mass formula in a rigorous way, which leads naturally to the use of experimental uncertainties and of the maximum-likelihood method to derive a set of equations for estimating the parameters and error of the theoretical model. By considering 1593 experimental masses from ^{16}O to ^{263}106 we estimate the error of the theoretical model to be 0.769 MeV. The model retains its accuracy far from stability and the values of the model parameters are very insensitive to details of the adjustment procedure. copyright 1988 Academic Press, Inc.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 49408

49998 **(LA-UR—88-1662) Collective relaxation, single particle motion and short range order in α'-NbD/sub x/: A quasielastic neutron scattering study.** Hempelmann, R.; Richter, D.; Faux, D.A.; Ross, D.K. (Los Alamos National Lab., NM (USA); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung; Institut Laue-Langevin, 38 - Grenoble (France); Birmingham Univ. (UK). Dept. of Physics). 1988. Contract W-7405-ENG-36. 10p. (CONF-880969—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88010944/JAW.

From Metal hydrogen systems fundamentals and applications conference; Stuttgart, F.R. Germany (4 Sep 1988).

Applying both incoherent and coherent quasielastic neutron scattering we have studied simultaneously single particle motion, collective relaxation and short range order of deuterium in α'-NbD/sub x/. A comparison with recent Monte Carlo simulations lead to a consistent description of all results in terms of strongly repulsive deuterium-deuterium interactions. Relating the independently determined tracer and chemical diffusion coefficients with the also measured structure factor we show experimentally that for lattice gases the de Gennes narrowing Ansatz needs to be modified by correlation factors. 18 refs., 3 figs., 1 tab.

49999 **(LA-UR—88-1987) Shielding the LANSCE [Los Alamos Neutron Scattering Center] 800-MeV spallation neutron source.** Russell, G.J.; Legate, G.L.; Robinson, H.; Woods, R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 20p. (CONF-880906—6). NTIS, PC A03. Order Number DE88014437/JAW.

From 7. international conference on radiation shielding; Bournemouth, UK (12 Sep 1988).

Neutrons produced by medium-energy (800-MeV) proton reactions at the Los Alamos Neutron Scattering Center spallation neutron source cause a variety of difficult shield problems. We describe the general shielding questions encountered at such a spallation source, and contrast spallation and reactor source shielding issues using an infinite slab-shield composed of 100 cm of iron and 15 cm of borated polyethylene. The calculations show that (for an incident spallation spectrum characteristic of neutrons leaking at 90 degrees from a tungsten target) high-energy neutrons dominate the dose at the shield surface. Secondary low-energy neutrons (produced by high-energy neutron attenuation) and attendant gamma-rays add significantly to the dose. The primary low-energy neutrons produced directly at the tungsten source contribute negligibly to the dose, and behave similarly to neutrons with a fission spectrum distribution. 8 refs., 10 figs.

50000 **(ORNL/TM—10810) An approximation for blackbody x-ray transport in air.** Haaland, C.M.; Santoro, R.T.; Barnes, J.M. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015377/JAW.

A simplified method is presented for approximating the air-transported x-ray spectrum from nuclear detonations in the atmosphere. Computational time is reduced such that a desk-top computer can provide results that match, within +- 10% for a wide range of conditions, Monte Carlo results which require about the same computation time on a Cray. The method consists of representing the black-body continuous spectrum by discrete emission windows, consulting tables of photon buildup factors for the discrete emission energies, unfolding the buildup photons by using air kerma response functions and an assumption for redistributing these photons to windows for lower energy, and applying cutoff and weighting factors to improve the correlation with the Monte Carlo benchmark calculations. 12 refs., 26 figs., 1 tab.

6550 Medical Physics

REFER ALSO TO CITATION(S) 48638, 49429, 49435, 49545

50001 (INIS-BR—1147-Vol.1, pp 131-137) **Mapping and monitoring the neutron flux density in a region near the IEA-R1 reactor core.** Dias, M.S.; Koskinas, M.F.; Silva, C.A.M.; Pocobi, E.; Machado, R. (Instituto de Fesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The procedure followed by the Nuclear Laboratory at IPEN (Sao Paulo) for mapping and monitoring the thermal neutron flux density in a region near the IEAR-1 reactor core is described. The mapped region, measuring 5.5 cm in diameter and 40 cm long, will be used to calibrate ion chambers or other neutron detectors produced at IPEN. About 80 activation foils, made of Au-Al alloy containing 0.130% of /sup 197/Au, were irradiated. The nuclide / sup 198/Au, obtained by (n,{gamma}) reaction, was measured in a NaI(TL) cintillator, which was calibrated by measuring some foils absolutely by means of a 4 {pi} (PC) {beta}-{gamma} coincidence system. The thermal neutron flux density was calculated as a function of the foil activity for all measured points and integrated in order to obtain the average neutron flux in the mapped region.

50002 (INIS-BR—1147-Vol.3, pp 63-71) **Internal dosimetry from IPEN workers involved in the medical radioisotopes production.** Cesar, R.B.P.; Mesquita, C.H. de. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The internal dose from IPEN workers involved in the medical radioisotopes products is related. In the workers population, six groups were classified: development and research, routine production, quality control, package, radioprotection supervision and maintenance. The internal doses were calculated according to the methodology described by the ICRP-30, using resuls from a whole-body counter. The results described were obtained from 970 whole-body radioactivity measurements during the last three years (1985 a 1987).

50003 (INIS-BR—1147-Vol.3, pp 73-81) **Interpretation of the results on urinalysis consequent of iodine 131 internal monitoring, in accordance with ICRP-35.** Duarte, C.L.; Gaburo, J.; Rangel, E.P. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

In this paper is presented a statistical survey of the data obtained from Iodine-131 analysis in urine for individual internal monitoring between 1982 and 1986, among the workers of the Radioisotope Processing Department of the IPEN/CNEN/SP. The evaluation of these data was made in accordance with the recommendation of ICRP-35 and were stablished the levels of reference: Recording, Investigation and Intervention. Then is discussed the radioprotection policy to be addopted when the levels of reference

are reached and finally were evaluated the conditions of the working place.

50004 (INIS-BR—1147-Vol.3, pp 121-128) **Influence of particle size in the lung dosimetry.** Carvalho, S.M.M. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

According to the ICRP lung model the deposition site of the inhaled particles depends on the activity or mass median aerodynamic diameters (AMAD, MMAD) of the aerosol particle size distribution. Based on the standard assumption that the AMAD of the distribution is 1 micrometer and assigning three different solubility classes, secondary limits have been derived for a well characterized individual called reference man. Variations in both particle size and solubility classification of the aerosol generated at the various installations may implay in different amounts of activity in the workers' lung than would be expected according to ICRP. This paper stresses the necessity to derive special limits for every Brazilian fuel cycle istallation according to the particle size analysis performed at different occupational areas.

50005 (INIS-BR—1147-Vol.3, pp 129-135) **Calibration of the IRD/CNEN whole-body counter unity for gamma-ray emitting radio-nuclides with energies greater than 200 KeV.** Lourenco, M.C.; Oliveira, C.A.N. de; Dantas, B.M.; Lucena, E.A. de. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

In order to calibrate the IRD Whole Body Counter Unit for {gamma}-ray emitting radionuclides with energies greater than 200 KeV a fiber glass mannequin, filled with polyehylene bags containing radioactive solutions of known activity, was used. Solutions of Cs-137, Mn-54, Co-60, K-40 and Ra-228 were prepared. Each phanton was counted by a NaI(Tl) 8″x4″ for 1000 minutes using a whole body geometry. Detection efficiency and full width at half maximum curves were plotted as function of the energy and minimum detectable activity evaluations were performed in the region of the mentioned radionuclides for a counting time of 30 minutes.

50006 (INIS-BR—1147-Vol.3, pp 143-153) **Conditions of radiation protection in medical stations.** Sa, L.R.B.S.; Tomaz Neto, A.; Pires, A.; Azevedo, H.; Boasquevisque, E.M. 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

The purpose of this study is to clear up what safety procedures are normally' observed for occupational and environmental radiology. 30 Public Medical station in Rio de Janeiro were investigated. A questionaire of 13 questions was prepared to be filled up by the professionals directly involved with the radiologic work, intending to evaluate, the personal and environmental aspect of radioprotection, the individual responsability of each worker and of the whole institution. It was also verified that knowledge of safety norms is doubtful and precarious in the despite of the fact that a great number of the people in question declare to have specific graduation for the activity. Only 45% from the total really make use of the dosimeters, the periodical medical examinations are not frequent (65%), and fewer employes make use of this lead apron (23%). We come to the conclusion that there is a remarkable bewilderment as for the personal observences about the work conditions in controlled areas.

50007 (INIS-BR—1147-Vol.3, pp 101-115) **Radioactive concrete sources at IRD/CNEN, Brazil, for calibration of uranium exploration and environmental field instruments.** Barreto, P.M.C.; Campos, C.A.; Malheiros, T.M.M.; Loborg, L. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil); Risoe National Lab., Roskilde (Denmark)). 1988. NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703249/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

A radiometric calibration system consisting of eight radioactive concrete sources was constructed at the Institute of Radiation Protection and Dosimetry (IRD) of the Brazilian Nuclear Energy Commission (CNEN). These sources, stimulating rock outcrops, are available to geophysicists interested in uranium explotation and scientists working with natural radioactivity in environmental research. The sources are of cylindrical shape with 3m diameter and 0.5m thickness weighing approximately 7.5 tonnes each. They are disposed in a circle having in its centre a 4m diameter water pond for cosmi-ray and instrument noise corrections. Uranium, thorium and potassium ores were added to the concrete under such conditions as to achieve perfect homogenization. One hundred and four samples were collected and analysed by eight laboratories. In addition, in-situ radiometric grade determination were performed with calibrated instruments resulting a total of 2.100 determinations of U, Th and K, from which the reference values were assigned to each source. With this system, it is possible to calculate sensitivity constants and stripping ratios for portable gamma-ray spectrometers. It also provides excellent means for the calibration of radiation detectors used in environmental monitoring, in which humidity, temperature and omni-directional gamma flux, similar to the natural environmental, are simulated.

50008 **(INIS-BR—1196) Whole body monitoring - Goiania.** Oliveira, C.A.N. de; Lourenco, M.C.; Bertelli Neto, L.; Lucena, E.A. de; Becker, P.H.B. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. 12p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704000/JAW.

Due to the radiological Cs accident in Goiania, Goias in September 1987, it became necessary to evaluate internal contamination levels of: - Individual from the general public that for any reason had direct or indirect involvement with the radioactive source (group 1). - Occupationally involved persons (group 2). For each of these groups, procedures of whole body monitoring were developped. In order to attend group 1 individuals, the IRD/CNEN installed a whole body unit in the INAMPS General Hospital of Goiania in 11.08.87, which was later transferred to 121,57 street, Central Sector in Goiania in 2.06.88. In this unit 547 people were monitored, 356 from group 1 and 241 from group 2, until 04.13.88. In the IRD whole body counter installation, 194 individuals were counted, 185 from group 2 and 9 from group 1. The frequency of monitoring of each individual was established according to the Cs activity present in the body or to the job to be assigned. In this paper we will present some burden activity curves for Cs 137 as a function of the time elapsed from the first measurement. There people from group 1 were measured in both counters, the IRD and the Goiania ones. The values obtained in both installations are compatible with the body activity x time curve.

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 49015, 49018, 49054, 49101, 49328

50009 **(AD-A—193948/7/XAB) Spectroscopic study of the absorption of C_2H_4 and C_2H_2 on a rare-earth single Crystal. 1. Metallic Gd(0001).** Simonson, R.J.; Wang, J.R.; Ceyer, S.T. (Massachusetts Inst. of Tech., Cambridge (USA). Research Lab. of Electronics). 1987. 16p. NTIS, PC A03/MF A01.

Pub. in Jnl. of Physical Chemistry, Vol. 91, No. 22, 5681-5695(1987).

The adsorption of ethylene and acetylene on a rare-earth-metal surface, Gd(0001), was studied primarily by ultraviolet photoemission and Auger electron spectroscopies. Both species adsorb

dissociatively on the clean Gd(0001) surface at 165 K to form adsorbed atomic carbon and hydrogen. At slightly higher coverages, carbon-hydrogen bond scission is no longer complete, resulting in a mixture of atomic carbon, CH, and CH_2. Sticking probabilities for both species are estimated to be in the range 0.2-0.4. Molecular adsorption occurs at 165 K after passivation of the Gd(0001) surface with adsorbed C and Hx species. As the substrate temperature is increased above 300 K, these molecularly adsorbed species dissociate rather than desorb. Gadolinium carbide is formed at higher temperatures.

50010 **(CONF-880169—1) Kinetics of ordering in Cu_3Au.** Nagler, S.E. (Florida Univ., Gainesville (USA). Dept. of Physics). 1988. Contract FG05-86ER45280. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014543/JAW.

From Time-resolved studies and ultrafast detectors workshop; Argonne, IL, USA (25 Jan 1988).

The kinetics of first-order phase transition of Cu_3Au is discussed. (LSP)

50011 **(CONF-880705—5) Neutron scattering study of the magnetic correlations of iron rich Fe-Zr glasses.** Fernandez-Baca, J.A.; Rhyne, J.J.; Erwin, R.W.; Fish, G.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014548/JAW.

From International conference on magnetism; Paris, France (25 Jul 1988).

Small angle neutron scattering (SANS) and polarized-beam spin rotation measurements show that amorphous Fe{sub 80}Zr{sub 10} does not exhibit conventional long range ferromagnetic order below T{sub C}. The SANS measurements show the existence of two characteristic length scales; one provides evidence of relatively large spin clusters, while the other is characteristic of the spin dynamics. 4 refs., 3 figs.

50012 **(CONF-880705—6) A critical scattering study of the helical antiferromagnets Ho and Dy.** Gaulin, B.D.; Hagen, M.; Child, H.R. (Oak Ridge National Lab., TN (USA); Keele Univ. (UK). Dept. of Physics). 1988. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014549/JAW.

From International conference on magnetism; Paris, France (25 Jul 1988).

We have measured the frequency integrated magnetic critical scattering of neutrons from paramagnetic Dy and Ho. Analysis of these data show the paramagnetic to helical antiferromagnetic phase transitions are characterized by the critical exponents $\nu = 0.57 +- 0.05$ and $\gamma = 1.05 = +- .07$ for Dy and $\nu = 0.57 +- .04$ and $\gamma = 1.14 = +- .10$ for Ho. 3 refs., 2 figs., 1 tab.

50013 **(DOE/ER/60503—T2) Excitons in the rare gas solids.** (Louisiana State Univ., Baton Rouge (USA)). [1988]. Contract FG05-87ER60503. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015152/JAW.

Excitons play a prominent role in the chemistry and physics of condensed matter. Excitons in the rare gas solids, the prototypical van der Waals insulators, will be the focus of the remainder of this report. The goal here is to investigate the controversies surrounding the description of excitons in insulators and, therefore the simplest class of these solids, namely the rare gas solids, is chosen as the exemplary system. Specific problems associated with molecular crystals are, therefore, avoided and only the salient features of excitons are thus considered. 47 refs., 9 figs., 4 tabs.

50014 (INIS-BR—1147-Vol.1, pp 357-361) **Influence of gamma radiation in the mechanical properties of polybutadiene.** Santos, L.G. dos; Silva Filho, E. (Cia. Pernambucana de Borracha Sintetica (Brazil); Pernambuco Univ., Recife (Brazil). Dept. de Energia Nuclear). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Samples of POLYBUTADIENE were irradiated with gamma rays from a /sup 60/Co sources, in time intervals to 20 days. Stress - Strain experiments were performed using a standard machine for physic tests. The results showedan irradiation induced hardening of the material.

50015 (INIS-BR—1147-Vol.2, pp 171-180) **Investigation of texture in samples of aluminium and iron-silicon by the neutron diffraction technique.** Pugliesi, R.; Yamazaki, I.M. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

By means of the neutron diffraction technique the texture of 5% and 98% rolled-aluminium and of iron-silicon steel used in the core of electric transformers, have been determined. The measurements were performed by using a neutron diffractometer installed at the IEA-R1 Nuclear Research Reactor, in the Beam-Hole N/sup 0/6. To avoid corrections such as neutron absorption and sample luminosity the geometric form of the samples were approximated to spheric or octagonal prism, and its dimensions do not exceed that of the neutron beam. The texture of the samples were analysed with the help of a computer programme that analyses the intensity of the diffracted neutron beam and plot the pole figures.

50016 (INIS-BR—1157, pp 51) **About the nature of a well defined interaction in the In/Ag/O system.** Pasquevich, A.F.; Bibiloni, A.G.; Desimoni, J.; Lopes G, A.R.; Massolo, C.P.; Sanchez, F.H. (La Plata Univ. Nacional (Argentina)). 1981. (In Spanish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88703560/JAW. (CONF-8109291—).

From 7. Latin American symposium on solid state physics; Gramado, Brazil (14 Sep 1981).

50017 (INIS-BR—1157, pp 57) **Induced ferromagnetism in a layered antifenomagnetic system.** Sakata, K.; Kaneyoshi, T.; Sarmento, E.F.; Fittipaldi, I.P. (Nagoya Univ. (Japan). Dept. of Physics; Alagoas Univ., Maceio (Brazil). Dept. de Fisica; Pernambuco Univ., Recife (Brazil). Dept. de Fisica). 1981. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88703560/JAW. (CONF-8109291—).

From 7. Latin American symposium on solid state physics; Gramado, Brazil (14 Sep 1981).

50018 **(INIS-BR—1178) Isotopic effect in the hydration reactions of 2, 2, 2 - trichloro - 1 - arylethanones.** Marconi, D.O.M.; Zucco, C.; Tanaka, A.S.; Nome, F. (Santa Catarina Univ., Florianopolis (Brazil). Dept. de Quimica). 1985. 14p. (In Portuguese). (CONF-8504335—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703871/JAW.

From 4. conference on organic physical chemistry; Florianopolis, Brazil (10 Apr 1985).

The equilibrium constants and rate constants for hydration and de-hydration of 2, 2, 2 - trichloro - 1 - arylethanones in tetrahydrofurane (THF) / H/sub 2/O - D/sub 2/O e THF/H/sub 2/O using the proton inventory technique involved in the transition state are studied. (M.J.C.).

50019 **(INIS-BR—1186) Conformational analysis of some 2-oxo-1, 3, 2 - dioxathiocanes.** Guimaraes, A.C.; Magalhaes, J.B. (Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Quimica; Fundacao de Ensino e Tecnologia de Alfenas (Brazil)). (Santa Catarina Univ., Florianopolis (Brazil). Dept. de Quimica). 1985. 32p. (CONF-8504335—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703879/JAW.

From 4. conference on organic physical chemistry; Florianopolis, Brazil (10 Apr 1985).

A study of the stereochemical properties of some 8 membered cyclic organic sulfites is presented. Some parameters obtained from /sup 1/H and /sup 13/C NMR spectra, as well as a qualitative and quantitative conformational analysis of sulfites are analyzed. (M.J.C.).

50020 **(INIS-BR—1187) Carbon-13 nuclear magnetic resonance of strained organic molecules: III estimates of steric effects.** Seidl, P.R.; Leal, K.Z.; Costa, V.E.U. (Instituto Militar de Engenharia, Rio de Janeiro (Brazil); Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Quimica). (Santa Catarina Univ., Florianopolis (Brazil). Dept. de Quimica). 1985. 10p. (CONF-8504335—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703880/JAW.

From 4. conference on organic physical chemistry; Florianopolis, Brazil (10 Apr 1985).

A study of cyclic organic molecules using carbon-13 NMR spectroscopy is analysed. The preparation of compounds and the use of norbornyl compounds as a basis for chemical shifts, bicyclic, tricyclic and tetracyclic derivatives are compared. Relevant distances, angles and non-bonded interactions are shown. (M.J.C.).

50021 **(INIS-BR—1219) Non-perturbative approach for laser radiation interactions with solids.** Jalbert, G. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil)). 1985. 134p. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88704011/JAW.

Multiphoton transitions in direct-gap crystals are studied considering non-perturbative approaches. Two methods currently used for atoms and molecules are revised, generalized and applied to solids. In the first one, we construct an S-matrix which incorporates the eletromagnetic field to all orders in an approximated way leading to analytical solution for the multiphoton transition rates. In the second one, the transition probability is calculated within the Bloch-Floquet formalism applieed to the specific case of solids. This formalism is interpreted as a classical approximation to the quantum treatment of the field. In the weak field limit, we compare our results with the usual perturbation calculations. We also incorporate, in the first approach, the non homogeneity and the multimodes effects of a real laser.

50022 **(INPE—4296) Experimental investigation of double layers formed by ion-acoustic turbulence.** Ludwig, G.O.; Ferreira, J.L.; Montes, A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Aug 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704036/JAW.

A small amplitude steady-state double layer is observed to form in a plasma tranversed by cold drifting electrons, v/sub d/ < v/sub e/. The double layers is shown to be associated with the anomalous resistivity caused by the ion-aeoustic instability driven by electron beam. The double layer is formed when the beam density is sufficienty large to exchange the instability by a bootstrap action, in agreement with particle simulation studies.

50023 (KURRI-TR—296, pp 82-85) **Temperature dependence of the electric field gradient in In metal.** Kawase, Y.; Uehara, S.; Nasu, S.; Fujita, F.E. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Nov 1987. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88900377/JAW. (CONF-8707148—).

From 1. KUR symposium on hyperfine interactions; Kyoto, Japan (20 Jul 1987).

50024 (KURRI-TR—296, pp 71-77) **PAC study of cadmium single crystal and alloys.** Hanada, Reimon. (Tohoku Univ., Sendai (Japan). Inst. for Materials Research). Nov 1987. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88900377/JAW. (CONF-8707148—).

From 1. KUR symposium on hyperfine interactions; Kyoto, Japan (20 Jul 1987).

The perturbation-angle correlation (PAC) method is based on the fact that radiations released from a nucleus show spatial anisotropy. The report present some results of studies in which the time-differential perturbation-angle correlation method is applied to /sup 111/In probe nuclei in cadmium metal and its alloys. The cyclotron at Tohoku University is used to irradiate plate-like single-crystalline and polycrystalline samples with proton radiations to implant /sup 111/In through the /sup 112/Cd(p,2n) /sup 111/In reaction. The perturbation terms (S/sub 1/, S/sub 2/ and S/sub 3/) of the theoretical formulae are examined based on the fact that the gradient of the electric field at a replacement position (position of / sup 111/In) is axially symmetric, with the major axis consistent with the c-axis of the crystal. Proton irradiation for the /sup 111/In implantation also causes radiation damage. Spectra measured immediately after irradiation consist of D-lines associated with defects and S-lines attributed to /sup 111/In located at defect-free positions. The D-lines start to fade as the annealing temperature reaches about 120 K, and completely disappear at 140 K. Using Cd-In alloys as samples, microscopic conditions of alloy elements in each phase in the phase diagram of the alloys are investigated by the PAC method. Brief comments are also made on calculation for analyzing PAC spectra. (Nogami, K.).

50025 **(LA-UR—88-2440) Spectroscopic evidence for 5f bands at room temperature in uranium-based heavy fermions.** Arko, A.J.; Koelling, D.D.; Dunlap, B.D.; Capasso, C.; del Giudice, M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 27p. (CONF-880914—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014395/JAW.

From 18. rare earth research conference; Lake Geneva, WI, USA (11 Sep 1988).

We present data on the alloy system UPd/sub 3-x/Pt/sub x/ and show that in the double hexagonal phase (x < 2.4) where the electrons are known to be localized, one obtains two Gaussian 5f features in the photoemission spectrum. A satellite (at ~-1eV) is found in the itinerant phase (x > 2.4) as well, except that the low-binding energy feature is locked in at E/sub F/ and shows evidence of energy dispersion at room temperature{endash}consistent with well-defined bands. Conversely, we show that even in well-behaved narrow band systems (USn$_3$ there is evidence for satellite formation. 44 refs., 8 figs.

50026 **(LBL—24379) Applications of high resolution ^{3}H NMR spectroscopy.** Williams, P.G. (Lawrence Berkeley Lab., CA (USA)). Oct 1987. Contract AC03-76SF00098. 6p. (CONF-880505—41). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014865/JAW.

From 3. topical meeting on tritium technology in fission, fusion and isotopic applications; Toronto, Canada (1 May 1988).

The advantages of tritium as an NMR nucleus are pointed out. Examples of its use are given, including labelled toluene, hydrogenation of β-methylstyrene, and maltose and its binding proteins. 7 refs., 2 figs. (DLC)

50027 **(LBL—24829) Nonlinear optical studies of organic monolayers.** Shen, Y.R. (Lawrence Berkeley Lab., CA (USA)). Feb 1988. Contract AC03-76SF00098. 10p. (CONF-8806190—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014657/JAW.

From International conference on organic materials for nonlinear optics; Oxford, UK (29 Jun 1988).

Second-order nonlinear optical effects are forbidden in a medium with inversion symmetry, but are necessarily allowed at a surface where the inversion summary is broken. They are often sufficiently strong so that a submonolayer perturbation of the surface can be readily detected. They can therefore be used as effective tools to study monolayers adsorbed at various interfaces. We discuss here a number of recent experiments in which optical second harmonic generation (SHG) and sum-frequency generation (SFG) are employed to probe and characterize organic monolayers. 15 refs., 5 figs.

50028 **(LBL—25409) Nonlinear dynamics in spinwaves.** Jeffries, C.D.; Bryant, P.H.; Nakamura, K. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 17p. (CONF-880703—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013594/JAW.

From Joint INTERMAG/magnetism and magnetic materials conference; Vancouver, Canada (11 Jul 1988).

For a yttrium iron garnet sphere at room temperature, an experimental study is made of the first order Suhl spinwave instability using perpendicular pumping at 9.2 GHz with the dc field parallel to the [111] crystal axis. The dynamical behavior of the magnetization is observed under high resolution by varying two control parameters, dc field (580 < H/sub o/ < 2100 G) and microwave

pump power (1 < P/sub in/ < 200 mW). Within this parameter space quite varied behavior is found: onset of the Suhl instability by excitation of a single spinwave mode with very narrow linewidth (<0.5 G); when two or more modes are excited, interactions lead to collective oscillations ("auto-oscillations") with a systematic dependence of frequency (10^4 to 10^6 Hz) on pump power, these oscillations displaying period-doubling to chaos; quasiperiodicity, locking, and chaos occur when three or more modes are excited; abrupt transition to wide band power spectra (i.e., turbulence), with hysteresis; irregular relaxation oscillations and aperiodic spiking behavior. A theoretical model of coupled modes is numerically evaluated and found to exhibit a behavior pattern similar to those observed experimentally. 24 refs., 5 figs.

50029 **(LBL—25543) Spin-orbit interaction effects in zincblende semiconductors: Ab initio pseudopotential calculations.** Li, Ming-Fu; Surh, M.P.; Louie, S.G. (Lawrence Berkeley Lab., CA (USA); University of Science and Technology of China, Beijing). Jun 1988. Contract AC03-76SF00098. 4p. (CONF-880884—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014663/JAW.

From 19. international conference on the physics of semiconductors; Warsaw, Poland (1 Aug 1988).

Ab initio band structure calculations have been performed for the spin-orbit interaction effects at the top of the valence bands for GaAs and InSb. Relativistic, norm-conserving pseudopotentials are used with no correction made for the gaps from the local density approximation. The spin-orbit splitting at Γ and linear terms in the {rvec char}k dependence of the splitting are found to be in excellent agreement with existing experiments and previous theoretical results. The effective mass and the cubic splitting terms are also examined. 6 refs., 1 fig., 2 tabs.

50030 **Charge exchange at molecular-orbital pseudocrossings as an important mechanism for nonkinetic-electron emission in slow-multicharged-ion (v<v$_0$) metal-surface scattering.** Snowdon, K.J.; Havener, C.C.; Meyer, F.W.; Overbury, S.H.; Zehner, D.M.; Heiland, W. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review [Section] A: General Physics;* **38**: No. 5, 2294-2304(1 Sep 1988).

Kinetic energy distributions of electrons emitted in the interaction of slow (10q-keV) multicharged ions (N,O,Ne,Ar) with metal surfaces (Cu,Au) are presented. We observe secondary-electron emission, quasiclastic-scattering processes, and, superimposed upon this, one-center Auger decay of both projectile and target vacancies. Two classes of target Auger-decay features are observed. Long-lived target vacancies decay, leading to discrete Auger line features, similar to those arising from electron-impact excitation. Short-lived target vacancies appear to decay in the field of the projectile, leading to broadened Auger line features. Observation of the decay of target vacancies, and their correlation with the presence of particular projectile vacancies, shows that a measurable fraction of projectile vacancies survive until small-impact-parameter collisions with surface or subsurface atoms. The data imply that projectile neutralization proceeds via two channels, viz., capture of valence-band electrons to projectile excited states, followed by one-center Auger decay, and at pseudocrossings of molecular orbitals correlating with discrete inner-shell levels of the target and projectile.

6561 Superconductivity

REFER ALSO TO CITATION(S) 49055, 49061, 49064, 49067, 49209

50031 **(AD-A—193432/2/XAB) Coupled even-parity superconducting states: square lattice. Technical report.** Langner, A.; Sahu, D.; George, T.F. (State Univ. of New York, Buffalo (USA). Dept. of Chemistry). Apr 1988. 12p. (UBUFFALO/DC—88/TR-67). NTIS, PC A03/MF A01.

The Ginzburg-Landau free-energy density for the coupling of s-wave and d-wave superconducting states in square planar symmetry is considered. Four single-order parameter states and a mixed state are enumerated along with analytical relations for their thermodynamic critical fields, Hc, and critical temperatures. The differential Ginzburg-Landau equations are derived and applied to the calculation of the upper and lower critical fields, Hc2 and Hcl. The relevance of the analysis to superconductivity in the Cu-O planes of the high-Tc materials is discussed.

50032 **(CONF-880812—Abstr.) Applied superconductivity conference: Abstracts.** (Lawrence Livermore National Lab., CA (USA); California Univ., Livermore (USA); Department of Energy, Washington, DC (USA). Office of Fusion Energy; Bechtel National, Inc., San Francisco, CA (USA); Teledyne-Wah Chang, Albany, OR (USA)). 1988. Contract W-7405-ENG-48. 90p. NTIS, PC A05; 3; GPO Dep. Order Number DE88013629/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

This publication is a compilation of the abstracts submitted to the 1988 Applied Superconductivity Conference. (JF)

50033 **(DOE/ER/45326—T1) [Theoretical studies of dynamics and correlations in heavy electron materials:]: Progress report, August 15, 1987-August 15, 1988.** (Ohio State Univ. Research Foundation, Columbus (USA)). 1988. Contract FG02-87ER45326. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013849/JAW.

This paper discusses progress in heavy electron research and high temperature superconductivity research. Particular topics discussed are: quadrupolar Kondo effect; coherence in the Anderson Lattice; Hall effect in heavy electron systems, suppression of superconductivity by disorder in strongly correlated electronic materials; and charge transfer mechanisms for high temperature superconductivity. (LSP)

50034 **(LA-UR—88-1646) Polarization induced pairing: an excitonic mechanism for high temperature T/sub c/.** Martin, R.L.; Bishop, A.R.; Tesanovic, Z. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-880968—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88010943/JAW.

From Symposium on high temperature superconductors; Los Angeles, CA, USA (26 Sep 1988).

The qualitative aspects of a recently proposed mechanism for superconductivity based on intra and interband Cu{leftrightarrow}O charge transfer excitations in the cuprates are reviewed. In this model, the dynamic polarizability of the environment surrounding the CuO_2 planes plays an important role in enhancing T/sub c/. The "sandwich" structures of $YBa_2Cu_3O_7$,$Bi_2Sr_2CaCu_2O_8$ and $Tl_2Ba_2Cu_3O_{10}$ are ideally suited to this mechanism. We briefly comment on the high T/sub c/ design principles suggested by the model. 14 refs., 2 figs.

50035 **(LA-UR—88-2277) Electrodynamics of single-crystal Eu{sub 2}CuO{sub 4}: A boson excitation spectrum.** Reagor, D.W.; Cheong, S.; Brown, S.E.; Migliori, A.; Fisk, Z.; Thompson, J.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 12p. (CONF-880669—10). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014328/JAW.

From International conference on science and technology of synthetic metals; Santa Fe, NM, USA (26 Jun 1988).

Static and microwave measurements of the electronic response of the planar cuprate Eu{sub 2}CuO{sub 4} provide evidence for thermally activated collective excitations. These observations together with microwave and other measurements on superconductors suggest that paired charge–carrying objects may exist both above and below T{sub c} in the superconductors. If these objects, which can be related to solitons of a spin density wave ground state, play a role in superconductivity, certain conclusions may be drawn. We discuss here the evidence for such objects and their implications. 19 refs., 5 figs.

50036 **(LBL—25482) Phonon-plasmon mechanism of high T/sub c/ superconductivity.** Kresin, V.Z.; Morawitz, H. (Lawrence Berkeley Lab., CA (USA)). May 1988. Contract AC03-76SF00098. 9p. (CONF-8805158—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014869/JAW.

From Latin American conference on high temperature superconductivity; Rio de Janeiro, Brazil (2 May 1988).

The observed high superconducting transition temperatures are caused, in our view, by the coexistence of strong electron-phonon coupling and the plasmon mechanism. A generalized Eliashberg equation describing the effects of phonons and plasmons on the pairing is presented. The structure of the plasmon bands in conducting, highly anisotropic layered materials are studied. 22 refs. 1 fig.

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 49905, 49933

50037 (AD-A—193221/9/XAB) Adaptive finite-element methods for shells. Final report, 1 September 1985-31 December 1987. Belytschko, T.; Liu, W.K.; Chang, H.G. (Northwestern Univ., Evanston, IL (USA). Dept. of Civil Engineering). 30 Jan 1988. 127p. NTIS, PC A07/MF A01.

An adaptive finite-element procedure is developed for the transient analysis of nonlinear shells. The scheme is an h-method that employs fission and fusion. Criteria based on incremental work and deviation of the bilinear finite-element approximation to the shell from a Kirchhoff-Love surface are used as criteria for adaptivity. The example problems show that the adaptive schemes are capable of achieving substantial improvements in accuracy for a given computational effort. They include both material and geometric nonlinearities and local and global buckling. In order to formulate an r-adaptive method, the conservation laws, the constitutive equations, and the equation of state for path-dependent materials are formulated for an arbitrary Lagrangian-Eulerian description. Both geometrical and material nonlinearities are included in this setting.

50038 (CBPF-NF—064/87) Criticality of the bond-diluted Ising ferromagnet in a semi-infinite simple cubic lattice. Silva, L.R. da; Tsallis, C.; Sarmento, E.F. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703959/JAW.

We study the phase diagram and universality classes of the quenched bond-diluted spin 1/2 Ising ferromagnetic in a semi-infinite simple cubic lattice with a (0,0,1) free surface. We observe that surface ferromagnetism persists below the d=2 percolation threshold p/sub c//sup 2D/= 1/2, in fact down to pc~0,42. (M.W.O.).

50039 (CEA-N—2561) Electron quantum interferences and universal conductance fluctuations. Benoit, A.; Pichard, J.L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique). May 1988. 30p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754717/JAW.

Quantum interferences yield corrections to the classical ohmic behaviour predicted by Boltzmann theory in electronic transport: for instance the well-known "weak localization" effects. Furthermore, very recently, quantum interference effects have been proved to be responsible for statistically different phenomena, associated with Universal Conductance Fluctuations and observed on very small devices.

50040 (DOE/ER/40272—57) Gravitational time delay due to a spinning string. Harari, D.; Polychronakos, A.P. (Florida Univ., Gainesville (USA). Dept. of Physics). 1988. Contract FG05-86ER40272. 8p. (UFTP—88-6). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014733/JAW.

We show that gravity around a straight cosmic string that carries angular momentum per unit length J induces a delay between the arrival time of two particles that describe an arbitrary closed trajectory around the string with the same speed at each point but in opposite directions. The time delay is $16\pi GJ$, where G is Newton's constant. The particle delayed is the one that circles the closed path in the sense contrary to the angular momentum. As a consequence, double images of a star produced by the string acting as a gravitational lens will acquire a relative time delay, thus providing a mechanism, at least in principle, to measure the string angular momentum. We argue, however, that in any realistic model the time delay effect is negligible. We also discuss other possible implications of this effect in 2 {plus} 1 dimensions. 13 refs., 1 fig.

50041 (IFT-P—04/88) Anti-BRS invariance and lagrangeanity in classical mechanics. Kraenkel, R.A. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1988. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703970/JAW.

By using a recently introduced path-integral formulation of classical mechanics we show that the existence of an anti-BRS-like invariance in classical mechanics is related to the existence of a lagrangian for the given equations of motion describing the system.

50042 (IFT-P—05/87) Canonical structure of Podolsky generalized electrodynamics. Galvao, C.A.P.; Escobar, B.M.P. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703971/JAW.

The generalized electrodynamics proposed by Podolsky is analyzed from the Hamiltonian point of view, using Dirac theory for constrained systems. The problem of gauge fixing for the theory is studied in detail and the correct generalization of the radiation gauge is obtained, a subject which has not been done correctly in the early literature. The Dirac brackets for the dynamical variables in this gauge are calculate.

50043 (IFT-P—09/88) Squeezed states phase space representation. Mizrahi, S.S.; Galetti, D. (Sao Carlos Univ. (Brazil). Dept. de Fisica). (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703973/JAW.

It is show that the Squeezed States Phase Space Representation of quantum mechanics is equivalent to the parametrized Wave-Packet Phase Space Representation which has been studied earlier by one of the authors.

50044 (IFUSP-P—647) Drell-Yan model for gentilionic quarks. Cattani, M.S.D.; Fernandes, N.C. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jun 1987. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703980/JAW.

Assuming that quarks are gentileons we show that fundamental properties of composed hadrons are rigorously predicted from first principles. Stimulated by these results we propose in this paper a modified quantum chormodynamics where, instead of fermions, gentileons interact with gluons. It is shown that, when Drell-yan model is adopted, our approach and the usual QCD give identical predictions for the hadronic properties.

50045 (IFUSP-P—658) Simplest gentilionic systems. Cattani, M.S.D.; Fernandes, N.C. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Aug 1987. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703982/JAW.

Basic quantum mechanical properties of systems constituted by two and three gentileons are deduced in this paper. As an immediate and natural result of our theoretical analysis, it is shown how fundamental observed properties of composed hadrons can be rigorously predicted from first principles assuming quarks as spin-1/2 gentileons.

50046 (IFUSP-P—659) Effective dynamics for subsystems and quantum many-body theory. Toledo Piza, A.F.R. de. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Aug 1987. 92p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88703983/JAW.

We discribed the many different approaches to the many-body problem and other related phenomena. (M.W.Q.).

50047 (IFUSP-P—670) Density matrix expansion for a convoluted wigner function. Nielsen, M.; Toledo Piza, A.F.R. de. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Nov 1987. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703985/JAW.

Using a coherent states phase space representation the distribution function corresponding to many-particles harmonic oscillator wavefunctions is obtained in explicit analytic expressions form. A density matrix expansion is performed and found to produce good approximations to the exact results.

50048 **(IFUSP-P—673) Bose-Einstein correlation of particles produced by expanding sources.** Hama, Y.; Padula, S.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Nov 1987. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703988/JAW.

Bose-Einstein correlation is discussed for particles produced by rapidly expanding sources, when kinematical effects hinder a direct relation between the observed correlations and the source dimensions. Some of these effects are illustrated by considering Landau's hydrodynamical model wherein each space-time point of the fluid with temperature T-T~mPI is taken as an independent and chaotic emitting center with Planck spectral distribution. In particular, this model reproduces surprisingly well the observed PI-PI and K-K correlations at the ISR.

50049 **(IFUSP-P—675) Hadrons, the simplest gentilionic systems.** Cattani, M.S.D. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Nov 1987. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703990/JAW.

Basic quantum mechanical properties of systems constituted by two and three gentileons are deduced in this paper. By using Pauli's theorem and symmetry properties of the intermediate states it is shown that, in some cases, gentileons must have half-odd-integral spin. As an immediate and natural result of our theoretical analysis, we show how fundamental observed properties of composed hadrons can be predicted from first principles assuming quarks as spin 1/2 gentileons.

50050 **(IFUSP-P—679) Excited states in stochastic electrodynamics.** Franca, H.M.; Marshall, T.W. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Dec 1987. 22p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703991/JAW.

It is shown that the set of Wigner functions associated with the excited states of the harmonic oscillator constitute a complete set of functions over the phase space. An arbitraty distribution can be expanded in terms of these Wigner functions. By studying the time evolution, according to Stochastic Electrodynamics, of the expansion coefficients, becomes feasible to separate explicity the contributionsof the radiative reaction and the vaccuum field to the Einsten. A coefficients for this system. A simple semiclassical explanation of the Weisskopf-Heitler phenomenon in resonance fluorescence is also supplied.

50051 **(IFUSP-P—680) Stochastic Electrodynamics and the Compton effect.** Franca, H.M.; Barranco, A.V. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Dec 1987. 58p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88703992/JAW.

Some of the main qualitative features of the Compton effect are tried to be described within the realm of Classical Stochastic Electrodynamics (SED). It is found indications that the combined action of the incident wave (frequency ω), the radiation reaction force and the zero point fluctuating electromagnetic fields of SED, are able to given a high average recoil velocity $v/c=\alpha/(1+\alpha)$ to the charged particle. The estimate of the parameter α gives $\alpha \sim$ Planck constantω/mc/sup 2/ where 2PIPlanck constant is the constant and mc/sup 2/ is the rest energy of the particle. It is verified that this recoil is just that necessary to explain the frequency shift, observed in the scattered radiation as due to a classical double Doppler shift. The differential cross section for the radiation scattered by the recoiling charge using classical electromagnetism also calculated. The same expression as obtained by Compton in his fundamental work of 1923 is found.

50052 **(INIS-BR—1210) Application of the recurrence method to the calculation of the electric field gradient in transition metals nucleus.** Petrilli, H.M. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1985. 119p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88704002/JAW.

It is presented a recurrence method to estimate the electronic contribution to the electric field gradient in the nucleus of transition metals. (M.W.O.).

50053 **(INIS-BR—1213) Quadrupolar analogue of the Ising model in the reaction field aproximation.** Lauck, S. (Santa Catarina Univ., Florianopolis (Brazil)). 1985. 62p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704005/JAW.

We describe the nematic phase of liquid crystals by a model analogo to the Ising model which in the continuum limit describe the quadrupolar interaction between molecules, whose dipoles are supposed to ocupy fixed positions in space. Their orientation are described by the discrete spin variable through their projections on the orientation direction caractherized in the nematic phase by the director vector. We consider a magnetic field applied in the same direction. We apply to this system the random phase approximation (RPA) whose results are better than those obtained by the Meier-Saupe mean field theory. We treat the model within the reaction field approximation (RFA) introduct the short range correlations and obtain better results than those obtained by RPA, with a lower critic temperature. Finally, we compare our results with other ones presented in the literarure envolving other and approximations.

50054 **(INIS-BR—1222) Composed particle model in stochastic electrodynamics.** Brunini, S.A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1985. 95p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704014/JAW.

We analyse the statistical properties of the non-relativistic motion of a particle that has two constituents having finite nasses and charges. The main interaction is in contact with thermal and zero point radiation of Stochastic Electrodynamics. (M.W.O.).

50055 **(INIS-BR—1223) Antiferromagnetic Ising model with transverse and longitudinal field.** Kischinhevsky, M. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil)). 1985. 88p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704015/JAW.

We study the quantum hamiltonian version of the Ising Model in one spacial dimension under an external longitudinal (uniform) field at zero temperature. A phenomenological renormalization group procedure is used to obtain the phase diagram; the transverse and longitudinal zero field limits are studied and we verify the validity of universality at non zero transverse fields, where two-dimensional critical behaviour is obtained. To perform the numerical calculations we use the Lanczos scheme, which gives highly precise results with rather short processing times. We also analyse the possibility of using these techniques to extend the present work to the quantum hamiltonian version of the q-state Potts Model ($q>2$) in larger system.

50056 **(INIS-BR—1224) Light scattering from a Fermi Liquid.** Vasconcellos, A.R.; Luzzi, R. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica). [1988]. 1p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704016/JAW.

50057 **(INIS-BR—1229) Progress Report 1985-1986.** (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1987. 180p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

The research directions in the Physics Institute of Universidade Federal do Rio Grande do Sul are presented. The progress reports cavied out in the follow areas are presented: perturbed angular correlation; Moessbauer spectroscopy; ion implantation; magnetism and electronic transport; microelectronics; condensed matter theory; quantum field theory; plasma physics; nuclear physics; astronomy and astrophysics; and instrumentation. (M.C.K.).

50058 **(LA-UR—88-2339) Properties of the DKP [Duffin-Kemmer-Petiau] equation.** Nieto, M.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-8806130—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014330/JAW.

From Relativistic nuclear many-body physics conference; Columbus, OH, USA (6 Jun 1988).

After recalling the development of relativistic quantum mechanics, I elucidating the properties of the Duffin-Kemmer-Petiau first-order wave equation for spin-0 and -1 mesons. The DKP equation is formally compared to the Dirac equation, and physically compared to the Klein-Gordon second-order equation for mesons. I point out where the DKP and KG equations predict the same results, and where their predictions are different. I conclude with an example of where these differences might interest people studying quark models of nuclei. 9 refs.

50059 **(LA-UR—88-2351) The inverse-square law and quantum gravity.** Nieto, M.M.; Goldman, T.; Hughes, R.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-8806193—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014332/JAW.

From Workshop on relativistic gravitation experiments in space; Annapolis, MD, USA (28 Jun 1988).

This paper briefly discusses a modification to central potential of gravity when antimatter is involved and the possible existence of quantum gravity and a fifth force of nature. 1 ref. (LSP)

50060 **(NUS-HEP—87/007) The Kac-Moody (KM) algebra and the chiral Wess-Zumino-Witten (WZW) Hamiltonian.** Baaquie, B.E. (Singapore Univ. (Singapore). Dept. of Physics). 1988. 29p. (CONF-8706318—1). NTIS (US Sales Only), PC A03; 1; GPO Dep. Order Number DE88012619/JAW.

From 1. Asia Pacific workshop on high energy physics, conformal field theories, anomalies and superstrings; Singapore, Singapore (29 Jun 1987).

An exact realization of the Kao-Moody (KM) generators as functional differential operators is discussed. The Wess-Zumino-Witten (WZW) Hamiltonian is defined; the unitary irreducible state space for the Hamiltonian at the conformal critical point is derived. 12 refs.

50061 **(SLAC-PUB—4525) Prephysics.** Gefwert, C.; McGoveran, D.; Noyes, P. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jan 1988. Contract AC03-76SF00515. 36p. (CONF-8709318—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015340/JAW.

From 9. annual international meeting of the Alternative Natural Philosophy Association; Cambridge, UK (23 Sep 1987).

This paper discusses philosophical aspects of physics. 84 refs. (LSP)

50062 **(SLAC-PUB—4527) Discrete physics: Practice, representation and rules of correspondence.** Noyes, H.P. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jul 1988. Contract AC03-76SF00515. 34p. (CONF-8709318—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015342/JAW.

From 9. annual international meeting of the Alternative Natural Philosophy Association; Cambridge, UK (23 Sep 1987).

We make a brief historical review of some aspects of modern physics which we find most significant in our own endeavor. We discuss the "Yukawa Vertices" of elementary particle theory as used in laboratory practice, second quantized field theory, analytic S-Matrix theory and in our own approach. We review the conserved quantum numbers in the Standard Model of quarks and leptons. This concludes our presentation of the "E-frame." We try to develop a self-consistent representation of our theory. We have already claimed that this approach provides a discrete reconciliation between the formal (representational) aspects of quantum mechanics and relativity. Also discussed are rules of correspondence connecting the formalism to the practice of physics by using the counter paradigm and event-based coordinates to construct relativistic quantum mechanics in a new way. 31 refs., 12 figs., 1 tab.

50063 **(UCRL—98448) A space-time representation of a massive, relativistic, spin zero particle.** Ziolkowski, R.W.; Shaarawi, A.M.; Besieris, I.M. (Lawrence Livermore National Lab., CA (USA)). Jul 1988. Contract W-7405-ENG-48. 6p. (CONF-880539—2). NTIS, PC A02. Order Number DE88014486/JAW.

From International symposium on spacetime symmetries; College Park, MD, USA (24 May 1988).

Novel solutions of the wave and the Klein{endash}Gordon equations are discussed. In contrast to conventional plant wave representations, these classical macro-photons and macro-particles are constructed from basis functions that are more localized in space{endash}time. These solutions can be designed to give directed, localized transmission of energy. They also exhibit properties which may reconcile contemporary ideas of photon localization and causality. 16 refs.

50064 **(UNB-FIS—01/88) Cluster approach for dilute magnetism.** Holvorcem, P.R.C.; Osorio, R. (Brasilia Univ. (Brazil). Dept. de Fisica). Jan 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704065/JAW.

A scheme is introduced for the study of site-dilute Ising models by means of the cluster-variation method. (M.W.O.).

50065 **(UNB-FIS—04/88) Surface modes in semi-infinite ferroelectrics.** Santos, A.R. dos; Oliveira, F.A. (Brasilia Univ. (Brazil). Dept. de Fisica). Jan 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704066/JAW.

We evaluate the response function for a ferroelectric with a perfect flat surface and a simple cubic structure.

50066 **(UWThPh—1988-13) Fermions in interaction with time dependent fields.** Falkensteiner, P.; Grosse, H. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704069/JAW.

We solve a two dimensional model describing the interaction of fermions with time dependent external fields. We work out the second quantized formulation and obtain conditions for equivalence of representations at different times. This implies the existence of sectors which describe charged states. We obtain the time dependence of charges and observe that charge differences become integer for unitary equivalent states. For scattering we require the equivalence of in- and out-representations; nevertheless charged sectors may be reached by suitable interactions and ionization is possible. 20 refs.

50067 **(UWThPh—1988-19) Entropic dimension for completely positive maps.** Narnhofer, H.; Benatti, F. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik; International School of Advanced Studies, Trieste (Italy)). (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1988. 22p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704072/JAW.

We extend the concept of quantum dynamical entropy h(γ) to cover the case of a completely positive map γ. For h(γ)=0 we examine the limit h/sub PHI/(N, γ, β)lim/sub n/1/n/sup β/H/sub PHI/(N, γN, ..., γ/sup n-1/N) calling the turning point β/sub 0/ between zero and infinite h/sub PHI/(N, γ, β) 'entropic dimension' D/sub N/(γ). The application of this theory to a solvable irreversible quantum dynamical semigroup on a one-dimensional fermion lattice provides any value of D/sub N/(γ) in between 0 and 1. 13 refs.

50068 **Using Einstein's method to derive both the Planck and Fermi—Dirac distributions.** Crawford, F.S. (Physics Department and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *American Journal of Physics;* **56**: No. 10, 883-885(Oct 1988).

Many quantum mechanics textbooks give the remarkable argument of Einstein wherein he introduces his famous "A and B coefficients" and uses detailed balancing to derive the Planck distribution for thermal photons. But it seems to be not widely known that the same approach can yield the Fermi—Dirac distribution for thermal electrons.

70 FUSION ENERGY

REFER ALSO TO CITATION(S) 50057

50069 (UCRL—98210) Managing high technology projects. Godwin, R.O. (Lawrence Livermore National Lab., CA (USA)). 12 Jul 1988. Contract W-7405-ENG-48. 4p. (CONF-8809110—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014481/JAW.

From Project Management Institute symposium; San Francisco, CA, USA (17 Sep 1988).

Good project management is important for the successful completion of all projects; however, for large high-technology projects it is essential. This paper describes the techniques and lessons learned during management of the $176M Nova Laser Fusion Project. That project was completed on schedule and within budget, despite the fact that many elements were state-of-the-art or beyond. 3 figs.

7001 Plasma Research

REFER ALSO TO CITATION(S) 48575, 48797, 48797, 49290, 49291, 49383, 49811, 49849, 49850, 50240, 50241, 50243, 50250, 50332, 50333, 50334

50070 (AD-A—192951/2/XAB) Electrostatic whistler-mode conversion at plasma resonance. Maggs, J.E.; Morales, G.J. (California Univ., Los Angeles (USA). Center for Plasma Physics and Fusion Engineering). Feb 1988. 47p. (PPG—1131). NTIS, PC A03/MF A01.

The mode conversion of an electrostatic whistler wave into a Bohm-Gross mode at plasma resonance is analyzed for a magnetized plasma with a longitudinal density gradient (i.e., Vno x B = 0). It is found that a whistler incident upon plasma resonance from inside the plasma converts, without producing a reflected wave, into a short-wavelength Bohm-Groiss mode that carries energy down the density gradient away from resonance. The detailed structure of the electric field near the resonance is found analytically. It is shown that the production of the Bohm-Gross wave by mode conversion can be described by a model of plasma resonance driven by a K = 0 electric field (i.e., the capacitor plate model). The relation between the driver amplitude and the amplitude of the incident whistler is derived.

50071 (CONF-8806177—1) Physics assessment of neutral beam injection in CIT. Houlberg, W.A.; Dory, R.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013198/JAW.

From CIT workshop on heating; Livermore, CA, USA (8 Jun 1988).

The large existing NBI database and our understanding of beam physics indicates that high energy neutral beams could be a very attractive back-up option for CIT because: flexibility of the heating profile is possible even with very restricted access; co-injection may provide an extra benefit in impurity control; and access to enhanced confinement regimes, e.g., H-Mode. High energy beam technology development should be pursued so that CIT could take advantage of these beneficial aspects of NBI.

50072 (DOE/ER/52122—3) High power microwave transmission systems for electron cyclotron resonance plasma heating: Progress report for the period September 1, 1987--August 31, 1988. Vernon, R.J. (Wisconsin Univ., Madison (USA). Dept. of Electrical and Computer Engineering). Aug 1988. Contract FG02-85ER52122. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015672/JAW.

This progress report is for the third year of a three-year grant from the Department of Energy (Contract DE-FG02-85ER52122) for the design, development, and fabrication of ECRH transmission and mode conversion systems to transport microwave power from a gyrotron (or other high power source) to a magnetically confined plasma. The development and testing of new and improved components for such systems and underlying theory, where necessary, is the focus of this project. Devising and improving component testing and diagnostic techniques is also an important part of this effort. 16 refs, 17 figs.

50073 (DOE/ER/53187—T4) Electron cyclotron heating and current drive in toroidal geometry: Technical progress report. Kritz, A.H. (Hunter Coll., New York (USA). Dept. of Physics). Jul 1988. Contract FG02-84ER53187. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015626/JAW.

In the past year, the range of experimental situations to which TORAY, our ECH ray tracing, heating and current-drive code, can be applied has been significantly broadened, and electron cyclotron heating and current-drive experiments on existing and planned tokamaks have been modeled. Also TORAY has been used in the design of several ECE diagnostics. The number of users of TORAY continues to increase. A version of TORAY, called TORCH, is now run under the BASIS operating system. While this form of the code is not easily transferred to other computers, it does have the advantage of allowing easier scanning of parameter space in searching for the optimization desired in a particular experiment. Another problem on which our work focussed is determining the sensitivity of transient synchrotron radiation to tokamak plasma parameters. The goal of this work is to examine the conditions under which incremental synchrotron radiation can be used as a diagnostic to determine values of plasma parameters such as Z/ sub Eff/ and q-profile as well as a diagnostic to determine the response of the plasma to rf-perturbations. 11 refs.

50074 (DOE/ER/53194—1) Nonlinear magnetohydrodynamics: Progress report for period January 1, 1987--June 30, 1988. Montgomery, D.C. (Dartmouth Coll., Hanover, NH (USA). Dept. of Physics and Astronomy). Aug 1988. Contract FG02-85ER53194. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015703/JAW.

We have analyzed the results of a variety of 3D numerical simulations of toroidal Z pinches in which their relaxation to an MHD state which is force-free, but not minimum-energy, was followed. Ananalytical calculation, based upon the principle of minimum energy dissipation rate, seems to account for many of the observed features. Tokamak temperature sawteeth about helical current channels have been observed in 3D Strauss equations computations. An analytical theory of MHD turbulent density fluctuations has been presented and confirmed numerically. The report is structured as follows. The activity of the last two years is summarized. Abstrcts of papers recently published and/or submitted are collected.

50075 (DOE/ER/53202—T17) Theoretical studies of controlled fusion: Final report. Krall, N.A. (JAYCOR, San Diego, CA (USA)). 31 Jul 1987. Contract FG03-85ER53202. 44p. (J—530-87-737/2442). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013521/JAW.

This report summarizes the results of a study of low frequency stability in the Field Reversed Configuration (FRC), with emphasis on the transport resulting from this stability behavior. Anomalous transport plays an obvious role in the confinement physics of the Field Reversed Configuration. Other anomalies are also observed, including an apparent absence of MHD instability and, in some cases, of lower-hybrid-drift instability. In current FRC experiments at LANL and Spectra Technology, particle, energy, and magnetic flux loss are observed to differ from classical prediction, both in size and in scaling. Early models proposed to explain that transport properties were based on anomalous radial loss of plasma particles in the vicinity of the separatrix between closed and open field lines produced by lower-hybrid instabilities. Our present work has shown that low frequency drift waves were also unstable in FRC, and produce energy and flux loss consistent with observation. 11 refs., 5 figs., 2 tabs.

50076 (DOE/ER/53212—T1) Theoretical reversed field pinch studies: Progress report, August 31, 1987 to June 1988. (Wisconsin Univ., Madison (USA)). 1988. Contract FG02-85ER53212. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014173/JAW.

This paper describes the progress made in Grant DE-FG02-85ER53212 since the end of the last year, August 31, 1987 to the present (June, 1988). Substantial results have emerged in two areas of high importance to the RFP program - nonlinear evolution with nonideal boundaries and self-consistent equilibrium in the presence of field errors. Both of these topics are critical for a basic understanding of RFP physics, for interpretation of current experiments, and for design of future devices and reactors. 3 refs.

50077 **(DOE/ER/53242—2) Experiments on linear high beta helical axis stellarators to study simulated toroidal effects and Alfven-wave heating: Annual progess report No. 2, November 16, 1987--July 15, 1988.** Ribe, F.L. (Washington Univ., Seattle (USA)). 1988. Contract FG06-87ER53242. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015514/JAW.

This report represents an update of the work described in Progress report No. 1 UWAERP/17 (2/16/87--10/15/87). During the present reporting period we have continued our work on the non-- axisymmetric Alfven wave heating of a high beta plasma column, and begun installation of the shifted hardcore heliac hardware. The hardware for the Alfven wave heating experiment has been assembled, installed, and tested. The preliminary experiment on the axisymmetric HBQM theta pinch compression coil set is scheduled to begin immediately. Details are given. The hardcore shifting apparatus has been built and is installed on one end of the HBQM, and the design and construction of the other end will proceed concurrently with experiments using a fixed hardcore. A design improvement in the hardcore shifting apparatus (since the last reporting period) has been implemented, motivated by the necessity of reliable operation at higher voltages.

50078 **(DOE/ET—51013-245) Summary of the discussion meeting on alpha particle theory problems.** Sigmar, D.J. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Apr 1988. Contract AC02-78ET51013. 15p. (PFC/CP—88-1; CONF-880190—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015085/JAW.

From Workshop on alpha particle theory problems; Austin, TX, USA (14 Jan 1988).

The agenda of the meeting (consisting of {approximately}20 theoreticians and 2 experimentalists working on single α-particle effects and diagnostics) was to discuss the spectrum of relevant α-theory problems as it is presently understood, its impact on ignited plasma performance, and possible paths to stabilization. The purpose was to expose existing efforts to peer review and to focus on the most important topics. Twenty-one talks were given which are summarized. Overall, there emerged a consensus about the existence of robust (MHD-like) collective oscillations affecting both the α-species and the bulk plasma. In addition, improved calculations of classical α-phenomena due to drift orbits and collisions and α-RF interactions were discussed. An overview of topics covered is given in the attached conference program.

50079 **(DOE/ET—51013-251) Massachusetts Institute of Technology Plasma Fusion Center 1987--1988 report to the President.** (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Jun 1988. Contract AC02-78ET51013. 24p. (PFC/IR—88-4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014800/JAW.

During the past year, technical progress has been made in all Plasma Fusion Center (PFC) research programs. The Plasma Fusion Center is recognized as one of the leading university research laboratories in the physics and engineering aspects of magnetic confinement fusion. Its research programs have produced significant results on several fronts: the basic physics of high-temperature plasmas (plasmas theory, RF heating, free electron lasers, development of advanced diagnostics, and intermediate-scale experiments on the Versator tokamak and Constance mirror devices), major confinement results on the Alcator C tokamak, including pioneering investigations of the stability, heating, and confinement properties of plasmas at high densities, temperatures and magnetic fields, experiments on the medium-scale TARA tandem mirror, including the development of novel MHD stabilization techniques in axisymmetric geometry, and a broad program of fusion technology and engineering development that addresses problems in several critical subsystem areas (e.g., magnet systems, superconducting materials development, environmental and safety studies, advanced millimeter-wave source development, and system studies of fusion reactor design, operation, and technology requirements.

50080 **(DOE/ET/53047—26) Confinement and heating of high beta plasmas with emphasis on compact toroids: Final progress report period ending February 15, 1987.** (Washington Univ., Seattle (USA). Aerospace and Energetics Research Program). 1987. Contract AS06-72ET53047. 108p. (UWAERP—14). NTIS, PC A06. Order Number DE88015777/JAW.

This report describes work performed at the University of Washington Aerospace and Energetics Research Program involving the "compact toroid" approach to magenetic confinement of plasmas. The five experiments comprising the effort are: The coaxial slow source experiment; the CSS project; the variable length experiment; the merging spheromak experiment; and the variable angle conical theta pinch experiment.

50081 **(DOE/ET/53088—322) Self-similar evolution of nonlinear magnetic bouyancy instability.** Shibata, K.; Tajima, T.; Matsumoto, R. (Texas Univ., Austin (USA). Inst. for Fusion Studies; Kyoto Univ. (Japan)). Jun 1988. Contract FG05-80ET53088. 15p. (IFSR—322). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015534/JAW.

A new type of self-similar solution of ideal magnetohydrodynamics in the nonlinear stage of undular mode (k {parallel} B) of magnetic buoyancy instability (Parker instability or ballooning instability) is found through MHD simulation and theory. The solution has the characteristics of nonlinear instability in Lagrangian coordinates; the fluid velocity and the Alfven speed on each magnetic loop increases exponentially with time, because the loop is evacuated by the field aligned motion of matter due to gravitational acceleration. 10 refs., 3 figs., 1 tab.

50082 **(DOE/ET/53088—330) The electron Fokker--Planck equation for collisions with ions in a magnetized plasma.** Ware, A.A. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Jul 1988. Contract FG05-80ET53088. 7p. (IFSR—330). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015535/JAW.

For those electrons whose Larmor radius is less then the Debye length, by averaging over binary collisions with ions and using a guiding-center approximation, a simple collision operator has been obtained which reproduces accurately the moments obtained from the existing more complex operators. 10 refs., 1 tab.

50083 **(DOE/ET/53088—331) Nonlinear growth of the quasi-interchange instability.** Waelbroeck, F.L. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Jul 1988. Contract FG05-80ET53088. 25p. (IFSR—331). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015536/JAW.

In this paper nonlinear effects on the growth of a pressure-driven, interchange-like mode are investigated. This mode is thought to be responsible for the sawtooth crashes observed in JET and successfully accounts for most of their features. The analysis presented here differs from previous bifurcation calculations by the inclusion of toroidal coupling effects. Toroidal curvature, which is important for pressure-driven modes, destroys the helical symmetry which is typical of kink-like instabilities. 14 refs., 3 figs.

50084 **(DOE/ET/53088—333) Stability thresholds of a disk-shaped Migma.** Wong, H.V.; Rosenbluth, M.N.; Berk, H.L. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Aug 1988. Contract FG05-80ET53088. 40p. (IFSR—333). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015533/JAW.

The stability of a Migma disc is re-examined to determined the threshold to the interchange instability. It is shown that a previous calculation which assumes a rigid mode eigenfunction, is inaccurate at the predicted particle number for marginal stability. As a result the integral equation for the system must be solved. A variational method of solution is developed and is shown to give good agreement with a direct numerical solution is developed and is

shown to give good agreement with a direct numerical solution. The threshold for instability is found to be sensitive to the details of the distribution function. For highly focused system, where all ions pass close to the axis, the threshold particle number (N/sup u1/) for instability is substantially below that predicted by rigid mode theory (N/sup rigid/)(by a factor {approximately}$8\epsilon^2$ where $\epsilon = r_i/r/\text{sub L}/$, r_i the spread in the distance of closest approach to the axis and r/sub L/ the ion Larmor radius). At a higher density a second band of stability appears that again destabilizes at yet higher article number (N/sub u2/). If ϵ {much-lt} 1, N/sub u2/ is substantially below the rigid mode prediction, while for $0.2 < \epsilon < 0.3$, N/sub u2/ is comparable to the rigid mode prediction. At moderate values of $\epsilon(\epsilon \sim 0.3$ {minus} 0.4) the second stability band disappears and the instability particle number threshold varies from about .4ϵ, when $\epsilon = 0.4$, to .7ϵ when ϵ is about unity. The stability criteria wound be consistent with the observed particle storage number obtained in experimental configurations if the spread in ϵ is sufficiently large. 11 refs., 6 figs., 6 tabs.

50085 (DOE/ET/53088—336) Periodic orbits for reversible, symplectic mappings. Kook, Hyung-tae; Meiss, J.D. (Texas Univ., Austin (USA). Inst. for Fusion Studies). 5 Aug 1988. Contract FG05-80ET53088. 54p. (IFSR—336). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015537/JAW.

A 2N dimensional symplectic mapping which satisfies the twist condition is obtained from a Lagrangian generating function F(q,q'). The q's are assumed to be angle variables. Reversible maps of this form have 2/sup N+1/ invariant symmetry sets topologically equivalent to N dimensional planes. We conjecture that such maps have at least 2/sup N/ symmetric periodic orbits for each frequency $\omega = (m,n)$. Furthermore, we conjecture there is an orbit which minimizes the periodic action for each ω, and 2/sup N/ {minus} 1 other "minimax" orbits. There is "dominant" symmetry plane on which the minimizing orbit is never observed to occur. As a parameter varies, the symmetric orbits are observed to undergo symmetry breaking bifurcations, creating a pair nonsymmetric orbits. A pair of coupled standard maps provides a four dimensional example. For this case the two dimensional symmetry planes give a cross section of the resonances and a visualization of the Arnold web.

50086 (DOE/FTR—8013036) [Participation in International Thermonuclear Experimental Reactor (ITER) specialists' meeting on current drive and heating, Garching, West Germany, 13-17 June 1988]: Foreign trip report. Smith, G.R. (Lawrence Livermore National Lab., CA (USA)). 8 Jul 1988. Contract W-7405-ENG-48. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013036/JAW.

During 13-17 June 1988, I attended the International Thermonuclear Experimental Reactors (ITER) Specialists' Meeting on Current Drive and Heating in Garching, West Germany. I presented US work and participated in discussions on the use of electron-cyclotron power in ITER. The reports of other US participants cover other current- drive and heating techniques: bootstrap, neutral beams, lower hybrid, and ion cyclotron. Presentations on EC experiments, past, present, and future, were comprehensive. Talks by myself and by G. Giruzzi both concluded that the best scenario for central current drive in ITER is fundamental O-mode, upshifted by 30-50% above the on-axis cyclotron frequency and launched from the outside. A subgroup on electron-cyclotron heating and current drive reached a consensus that EC power could perform the following roles: initial breakdown, heating to ignition, profile control, and bulk current drive. The subgroup also identified areas that require further work.

50087 (GA-A—19222) DIII-D annual report for the period FY87. Colleraine, A.P. (ed.). (General Atomics Co., San Diego, CA (USA)). Apr 1988. Contract AC03-84ER51044. 188p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE88015390/JAW.

The 1987 fiscal year was marked by the return of the DIII-D tokamak to full productivity. This return was highlighted by noteworthy results over a wide range of topics including beta and the setting of record beta values, confinement, impurity studies, ECH heating, ICRF coupling studies, and current drive. The DIII-D device, with its new dee-shaped vacuum vessel was brought into operation during FY86, and extensive studies were performed during that year focused on establishing high quality 1 MA divertor and 2.5 MA elongated limiter discharges in preparation for neutral beam injection studies.

50088 (INPE—4100) Linear and non-linear ion acoustic phenomena in magnetic multi-dipole discharges. Ferreira, J.L. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Dec 1986. 178p. (In Portuguese). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704031/JAW.

An experimental study of ion acoustic phenomena in a multi-magnetic-dipole plasma device is presented. The plasma is uniform and free from external field, permitting good observation of space and laboratory plasma phenomena. The major interest was in the observtion of the propagation characterics of solitions and ion acoustic waves in a double plasma configuration. In this experiment plane waves were studied in a plasma composed by a mixture of negative and positive ions. The most important result was the first observation of solitary waves with negative potential, that means rarefaction ion acoustic solitions. The formation of non neutral regions inside the plasma and its relations with the inhibition of electron thermal flux were studied. A bootstrap action enhances the ion acoustic instability which generates an anomalous resistivity self consistently with a potential step. It was observed that this is the mechanism of cold electron thermalization during diffusion through a warn collisionless plasma. The importance of the bootstrap action in ion acoustic double layer formation was experimentally verified by ion acoustic instability inhibition, obtained via induced Landau damping of the ion acoustic spectrum of the instability.

50089 (INPE—4240) Gyrotron development at the Instituto de Pesquisas Espaciais. Barroso, J.J.; Castro, P.J. de; Correa, R.A.; Galvao, G.P.; Ludwig, G.O.; Montes, A.; Nono, M.C.A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Jul 1987. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704032/JAW.

The conceptual design of a 35GHz gyrotron operating in the TE/sub 01/ mode, intended for plasma heating experiments, is presented. The electrooptical system is sinthesized from electron beam parameters in the cavity region and the electrodynamical system includes a conventional resonator consisting of truncated cones. The starting and operating characteristics are calculated by integrating the exact equation of electron motion under de action of an RF field with fixed spatial distribution. The experimental activities are concentrated on the construction of a system of magnetic coils, able to generate a 15 KG magnetic induction with a fluctuation of 0.1% over an extension of 13 cm; the manufacture of caerties by using electroforming techniques; and the development of techiques for the construction of electron guns.

50090 (INPE—4241) Design, construction and operation of a small RFP for turbulent plasma studies. Aso, Y.; Galvao, R.M.O.; Ueda, M. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Jul 1987. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704033/JAW.

A small RFP (Reversed Field Pinch) apparatus for turbulent plasma studies, which is called CECI (Configuracao de Estriccao a Campo Inverso) is described. The apparatus has a major radius of 12 cm and a minor radius of 4.2 cm.

50091 (INPE—4292) Double layer formed by beam driven ion-acoustic turbulence. Ludwig, G.O.; Ferreira, J.L.; Montes, A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Aug 1987. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704035/JAW.

Small amplitudes steady-state ion-acoustic double layers are observed to form in a plasma transversed by a beam of cold electrons. The importance of turbulence in maintaining the double layer is demonstrated. The measured wave spectrum is in approximate agreement with models deriveted from renormalized turbulence theory. The general features of the double layer are compared with results from particle simulation studies.

50092 **(INPE—4322) Measurements Techniques for Gyrotron characterization.** Castro, P.J. de. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Aug 1987. 38p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704037/JAW.

Experiments planned for the characterization of the 35GHz girotron, which is being built at the Plasma Laboratory of INPE, are described. The methods of the measurements are presented and the required instrumentation and devices are specified. Special attention is given to the measurement techniques of the resonator electric field profile.

50093 **(INPE—4336) Trip electrical circuit of the gyrotion.** Rossi, J.O. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 76p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704038/JAW.

The electron cyclotron resonance heating system of INPE/LAP is shown and the trip electrical circuit of the gyrotron is described, together with its fundamental aspects. The trip electrical circuit consists basically of a series regulator circuit which regulates the output voltage level and controls the pulse width time. Besides that, a protection circuit for both tubes, regulator and gyrotron, against faults in the system.

50094 **(INPE—4357) Synthesis method for using in the design of an electron gun for gyrotion.** Silva, C.A.B. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 163p. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704039/JAW.

In this work a synthesis method is applied to the design of an electron gun for a 94GHz gyrotron. Using the synthesis method, it is found the shape of the electrodes compatible with the laminar flow which minimizes the action of space change on the electron velocity dispersion. A sistematic procedure is presented to fuid the parameters of the synthesis method which, in turn, are closely related to the characteristics of the aptoclechonic system.

50095 **(INPE—4378) Nonlinear diffusion in the presence of a time-dependent external electric field.** Lima e Silva, T. de; Galvao, R.M.O. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. Tecnologico de Aeronautica). (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704040/JAW.

The influence of a time-dependent external electric field on the nonlinear diffusion process of weakly ionized plasmas is investigated. A new solution of the diffusion equation is obtained for the case when electron-ion collisions can be neglected.

50096 **(INPE—4381) Ray-tracing study of electron cyclotron resonance heating in Tokamak plasmas with a superthermal electron tail.** Montes, A.; Dendy, R.O. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704041/JAW.

We consider a Tokamak plasma in which the distribution of electron velocities in the direction parallel to the magnetic field has a monotonically decreasing superthermal tail. A fully three-dimensional ray-tracing code, which includes a realistic antenna pattern, toroidal effects, and refaction, is used to calculate the absorption of the extraordinary mode in the nonrelativistic limit away from perpendicular incidence. The ray-tracing approach extends results previously obtained in slab geometry (3-8) to a more realistic configuration; it is also essential in dealing with strong refraction in high-density plasmas. Our analytical model for the tail makes available a wide range of tail shapes and parameters. At low densities small tails (tail fraction $<=0.5\%$) can significantly affect wave absorption and energy deposition profiles. In a high-density plasma where the fundamental cyclotron resonance is cut-off, tail electrons in the edge region can cause substantial absorption. The use of a gyrotron with frequency much less than the central electron cyclotron frequency with an outside Launch position is confirmed as very effective in the presence of very few tail electrons (tail fraction $\sim$ 0.5%).

50097 **(INPE—4383) Recent results of plasma research activities at the Instituto de Pesquisas Espaciais.** Barroso, J.J.; Bittencourt, J.A.; Dallaqua, R.S.; Del Bosco, E.; Ferreira, A.; Ferreira, J.L.; Galvao, G.P.; Galvao, R.M.O.; Ludwig, G.O.; Montes, A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704042/JAW.

Recent results obtained in different experiments at the Institute for Space Research (INPE) are reported. An enrichment of 390% of carbon isotopes has been achieved in the plasma centrifege. The role of ion-acoustic turbulence in the formation of double layers has been experimentaly investigated. The turbulent spectrum has been measured and agrees quite well with the prediction of the modified Kadomtsev's renormalized theory. The characteristics of the gyrotron that is presently being built at INPE and new techniques for gyrotron design are discussed. Thecretical results on the generalized Spitzer-Harm problem, current drive in the start-up phase of Tokamaks, and quasilinear theory of beat-wave current drive are also presented.

50098 **(INPE—4384) Generalized description of the anomalous doppler resonance and the stabilizing role of ion dynamics.** Dendy, O.; Lashmore-Davies, C.N.; Montes, A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704043/JAW.

The anomalous Doppler effect is of interest as a fundamental limit on superthermal tail formation in Tokamak plasmas, and as a probable explantation of the relaxation oscillations seen in the soft X-ray signal from Ohmic plasmas and in association with lower hybrid current drive. In this application, the divergence of fast-electron motion from the parallel direction as the anomalous Doppler instability proceeds is responsible for the shift in the predominant direction of electron bremsstrahlung, which follows the fast-electron motion. A number of studies have considered such quasi-linear development of the instability. The linear instability remains of interest, however, and we shall examine this aspect of the phenomenon.

50099 **(INPE—4385) Absorption of electron cyclotron waves by super-thermal electron velocity distribution in Tokamak plasmas.** Montes, A.; Dendy, R.O. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704044/JAW.

We consider a Tokamak plasma in which the distribution of electron velocities in the direction paralletl to the magnetic field has a monotonically decreasing superthermal tail. A fully three-dimensional ray-tracing code is used to calculate the absorption of the extraordinary mode in the nonrelativistic limit. The results indicate that small tails (tail fraction $<=$ 0.5%) can significantly affect wave absorption at low densities. In a high-density plasma where the extraordinary mode cutoff is present, tail electrons can cause substantial absorption. The use of a gyrotron with frequency much less than the central electron cyclotron frequency with an outside launch position is found to be verg effective in the presence of tail electrons.

50100 **(INPE—4386) Observations of an ion acoustic oscillation near a pulsed sheath.** Braithwaite, N.S.J.; Allen, J.E.; Ferreira, J.L. (Oxford Univ. (UK)). (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704045/JAW.

Informations of density rarefaction and subsequent compression associated with a single negative voltage pulse on a spherical electrode, is presented.

50101 (INPE—4389) Effect of asymmetric current-supporting electron velocity distributions on second harmonic electron cyclotron resonance heating: a ray-tracing treatment for the campass tokamak. Dendy, R.O.; Montes, A.; Leite, J.P. (Association Euratom - UKAEA Fusion, Abingdon (UK)). (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704046/JAW.

A limited asymmetric distortion of the distribution of electron velocities parallel to the magnetic field, sufficient to support the plasma current, is considered. Its effects on second harmonic electron cyclotron absorption of the extraordinary mode propagating away from normal incidence are qunatified using a fully three-dimensional ray-tracing code. Significant derivations from the zero current power deposition profiles occur, both in real space and in velocity space. At higher densities, the effects of the extraordinary mode cutoff are softened.

50102 (INPE—4390) Single particle and collective descriptions of the anomalous Doppler resonance and the role of ion dynamics. Dendy, R.O.; Lashmore-Davies, C.N.; Montes, A. (Association Euratom-UKAEA Fusion, Abingdon (UK)). (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704047/JAW.

The power J.E/sup */ dissipated by electrostatic waves interacting with a non-Maxwellian electron velocity distribution is evaluated. Its component terms illustrate the similarities and differences between collctive and single particle treatments of the anomalous Doppler resonance. The large-K region is investigated to evaluate the importance of ion dynamics in stabilizing plasmas. The sensitivity of theoretical descriptions to represent the superthermal electron tail is studied analytically and numerically.

50103 (INPE—4392) Large amplitude solitary waves in a multicomponent plasma with negative ions. Nakamura, Y.; Tsukabayashi, I.; Ludwig, G.O.; Ferreira, J.L. (Institute of Space and Astronautical Science, Tokyo (Japan)). (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704048/JAW.

When the concentration of negative ions is larger than a critical value, a small compressive pulse evolves into a subsonic wave train and a large pulse develops into a solitary wave. The threshold amplitude and velocity of the solitary waves are measured and compared with predictions using the pseudopotential method.

50104 (INPE—4393) Experiments on ion-acoustic rarefactive solitons in a multi-component plasma with negative ions. Nakamura, Y.; Ferreira, J.L.; Ludwig, G.O. (Institute of Space and Astronautical Science, Tokyo (Japan)). (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704049/JAW.

Ion-acoustic solitons in a three-component plasma which consists of electrons, positive and negative ions have been investigated experimentally. When the concentration of negative ions is smaller than a certain value, positive or compressive solitons are observed. At the critical concentration, a broad pulse of small but finite amplitude propagates without changing its shape. When the concentration is larger than this value, negative or rarefactive solitons are excited. The velocity and the width of these solitons are measured and compared with predictions of the Korteweg- de Vries equation which takes the negative ions and the ion temperature into consideration. Head-ion and over-taking collisions of the rarefactive solitons have been observed to show that the solitons are not affected by these collisions.

50105 (INPE—4396) Relativistic electromagnetic waves in an electron-ion plasma. Chian, A.C.-L.; Kennel, C.F. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil); California Univ., Los Angeles (USA). Inst. of Geophysics and Planetary Physics). (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1987. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704050/JAW.

High power laser beams can drive plasma particles to relativistic energies. An accurate description of strong waves requires the inclusion of ion dynamics in the analysis. The equations governing the propagation of relativistic electro-magnetic waves in a cold electron-ion plasma can be reduced to two equations expressing conservation of energy-momentum of the system. The two conservation constants are functions of the plasma stream velocity, the wave velocity, the wave amplitude and the electron-ion mass ratio. The dynamic parameter, expressing electron-ion momentum conservation in the laboratory frame, can be regarded as an adjustable quantity, a suitable choice of which will yield self-consistent solutions when other plasma parameters have been specified. Circularly polarized electromagnetic waves and electrostatic plasma waves are used as illustrations.

50106 (IPP—2/291) Fast bolometer for the WVII-AS stellarator. Jaeckel, H.J.; Kuehner, G.; Perchermeier, J. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Apr 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754662/JAW.

A fast germanium bolometer for plasma diagnostics in the WVII-AS advanced stellarator is described. A stainless-steel foil is used as absorber, and germanium as thermally sensitive material. Short response time and high sensitivity of the bolometer where achieved using a 1.6 μm MgO layer as insulation between the germanium and the SS foil and by doping the germanium with oxygen, respectively. An overall heat capacity C/sub bol/ = 2.1 mJ/K and a temperature coefficient α of the germanium of α ≅ 4%/K were thus obtained. The thermal response time is tau/sub r/ ≅ 10 μs and the decay time tau/sub d/ ≅ 1 s. Two 30-channel cameras for diagnostics in WVII-AS are to be equipped with the bolometers.

50107 (IPP—6/273) Negative energy waves in the framework of Vlasov-Maxwell theory. Pfirsch, D. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Mar 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754663/JAW.

On the basis of a variational formulation of the Vlasov-Maxwell theory it was recently shown that, for instance, all magnetically confined plasmas allow the existence of negative energy waves. Such waves can become nonlinearly and dissipatively unstable and might therefore be of importance in explaining anomalous transport. The proof of this result uses infinitely strongly localized perturbations. This is, however, not necessary: in this paper it is shown by discussing general, homogeneous, magnetized plasmas that the necessary localization is related to the average gyroradius tau/sub g/ of the relevant particle species. For unstable plasmas the extent or wavelengths of negative energy waves can be of the order of tau/sub g/, whereas for linearly stable plasmas the extent can be a small fraction of tau/sub g/.

50108 (IPP—III/125) Linear stability of microtearing modes in ASDEX. Giannone, L. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Dec 1987. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754664/JAW.

The linear stability of microtearing modes in typical ASDEX discharges have been calculated. In the case of Ohmic discharges it was found that unstable modes are predicted to be located towards the centre of the plasma. For L and H discharges the zone of instability shifts towards the plasma edge. The interpretation of an increase or decrease in the amplitude of broadband magnetic fluctuations during L and H discharges must be interpreted with caution, since the amplitude observed is strongly dependent on the radial position of the instability.

50109 (LA—11296-MS) Current new applications of laser plasmas. Hauer, A.A.; Forslund, D.W.; McKinstrie, C.J.; Wark, J.S.; Hargis, P.J. Jr.; Hamil, R.A.; Kindel, J.M. (Los Alamos National Lab., NM (USA)). Sep 1988. Contract W-7405-ENG-36. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015679/JAW.

This report describes several new applications of laser-produced plasmas that have arisen in the last few years. Most of the applications have been an outgrowth of the active research in

laser/matter interaction inspired by the pursuit of laser fusion. Unusual characteristics of high-intensity laser/matter interaction, such as intense x-ray and particle emission, were noticed early in the field and are now being employed in a significant variety of applications outside the fusion filed. Applications range from biology to materials science to pulsed-power control and particle accelerators. 92 refs., 23 figs., 4 tabs.

50110 **(LA-UR—88-1788) Boundary-value approach to nuclear effects in muon-catalyzed d-t fusion.** Hale, G.M.; Struensee, M.C.; Pack, R.T.; Cohen, J.S. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 11p. (CONF-8805170—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014469/JAW.

From Muon catalyzed fusion workshop; Sanibel Island, FL, USA (2 May 1988).

The use of boundary-matching techniques, as contained in R-matrix theory, to describe multichannel nuclear reactions is discussed. After giving a brief summary of the application of such techniques to the nuclear reactions in the ^{5}He system, we discuss a simple extension of the description to include muons, which was used to calculate nuclear effects on the L = O eigenvalues of the $dt\mu$ molecule in various adiabatic approximations. Next, the form of the outgoing $n\alpha\mu$ wavefunction is discussed, resulting in a new formulation of the amplitudes used to calculate the α-μ sticking fraction. Possible methods of solving for these amplitudes using the boundary-value approach are suggested, and some deficiencies of the "standard" expression for the sticking amplitudes are pointed out. 3 figs., 3 tabs.

50111 **(LBL—25005) Gain measurements at 5 nm in nickel-like ytterbium.** MacGowan, B.J.; Bourgade, J.L.; Combis, P.; Keane, C.J.; Louis-Jacquet, M.; Matthews, D.L.; Naccache, D.; Stone, G.; Thiell, G.; Whelan, D.A. (Lawrence Berkeley Lab., CA (USA)). Mar 1988. Contract AC03-76SF00098;W-7405-ENG-48. 4p. (CONF-880706—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014662/JAW.

From International quantum electronics conference; Tokyo, Japan (18 Jul 1988).

Soft x-ray gain has been demonstrated at 5.03 nm within a laser produced plasma of Ni-like ytterbium. Experiments will also be described with higher Z Ni-like ions which can produce even shorter wavelength x-ray laser transition. 3 refs.

50112 **(PPPL—2517) Nonlinear tearing instabilities in tokamaks with locally flattened current profiles.** Reiman, A.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jul 1988. Contract AC02-76CH03073. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015867/JAW.

Nonlinear tearing stability is evaluated for current profiles which are linearly stabilized by flattening the current in the neighborhood of the rational surface. When marginally stable to the linear instability, these profiles remain unstable in the presence of a small but finite island. The growth of the island saturated only when the island reaches the width it would have attained in the absence of flattening. Implications are discused for proposed methods of tearing mode stabilization and for theories of the tokamak sawtooth oscillation. 19 refs., 1 fig.

50113 **(PPPL—2525) Transport simulations of ohmic pellet experiments on the TFTR, ASDEX, and ALCATOR-C tokamaks.** Redi, M.H.; Tang, W.M.; Owens, D.K.; Greenwald, M.; Gruber, O.; Kaufmann, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jul 1988. Contract AC02-76CH03073. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015866/JAW.

Transport simulations of ohmic gas-fuelled and pellet-fuelled experiments have been carried out to test a microinstability-based, profile-consistent model of anomalous transport in tokamaks. Predictions for experiments on the TFTR, ASDEX, and ALCATOR-C tokamaks were found consistent with the observed confinement and temperature measurements. 26 refs., 11 figs., 10 tabs.

50114 **(PPPL—2537) Investigation of spheromak configuration generated by inductive methods in the S-1 device.** Yamada, M.; Janos, A.C.; Ellis, R.A. Jr.; Hart, G.W.; Levinton, F.M.; Mayo, R.M.; Meyerhofer, D.D.; Mimura, M.; Motley, R.W.; Ono, Y.; Paul, S.; Ueda, Y. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1988. Contract AC02-76CH03073. 93p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88015865/JAW.

This paper summarizes the characteristics of the spheromak plasmas obtained during the past five-year operation period of S-1 experiments. The S-1 Spheromak device, which began operation in 1983, generates a compact toroid in which the self-generated toroidal field in the plasma is comparable to the poloidal field. The S-1 experiment is unique in that spheromak plasmas are formed by inductive transfer of magnetic flux from a toroidal-shaped "flux core," and plasma stability is maintained by shaping of the externally applied equilibrium field and using loose-fitting passive conductors. The most important objective for the S-1 experiment is to investigate the confinement feature of the spheromak configuration. With a rather extensive diagnostic system for this size device, the transport characteristics of the S-1 spheromak have been measured for plasmas with 10 {approx←lt} T/sub e/ ≦ 130 eV and 2 {approx←lt} n/sub e/ {approx←lt} 15 {times} 10^{13} cm/sup {minus}3/. The scaling of electron temperature T/sub e/ and density n/sub e/ with plasma current density has been obtained in a wide operation regime. The most important finding is that the peak electron pressure scales as n/sub eo/T/sub eo/ {proportional←to} j/sub o/^{2} (j/sub o/ = peak toroidal current density) with T/sub eo/ {proportinal←to} j/sub o/^{2} and n/sub eo/ ≃ constant. These scaling results, which are similar to those obtained in the reversed-field pinch device, suggest that β = constant. Energy and particle confinement times are determined. 44 refs., 35 figs.

50115 **(PPPL—2538) Impurity behavior in PBX L- and H-mode plasmas.** Ida, K.; Fonck, R.J.; Sesnic, S.; Hulse, R.A.; LeBlanc, B.; Paul, S.F. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1988. Contract AC02-76CH03073. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015864/JAW.

Intrinsic impurity behavior and transport properties in neutral-beam-heated L- and H-mode PBX tokamak plasmas were studied with a variety of impurity diagnostics. Central impurity accumulation was most often observed in H-mode discharges and sometimes resulted in a thermal collapse due to high central metallic radiation (— 1.5 W/cm^3). The accumulation was evident from peaked Z/sub eff/ and radiated power profiles and further substantiated from specific VUV and X-ray spectroscopy measurements. It is shown that impurity accumulation was neither unique nor inevitable in H-mode discharges, and it could be suppressed by sufficient gas puffing. Central accumulation was also seen in L-mode plasmas even with co-injected neutral beams. This usually occurred at high beam power and relatively low density. While there was no significant difference in the degree of accumulation between L- and H-mode discharges, the Z/sub eff/ profile itself was more peaked in the H-mode due to flatter electron density profiles in H-mode plasmas than in L-mode plasmas. The degree of accumulation increased as Z/sub eff/(0) itself increased and is qualitatively explained by neoclassical convection and diffusion driven by impurity--impurity collisions in addition to the usual impurity--plasma ion contributions in the central plasma region of interest. 44 refs., 20 figs.

50116 **(PPPL—2539) Corrections to charge exchange spectroscopic measurements in TFTR due to energy-dependent excitation rates.** Howell, R.B.; Fonck, R.J.; Knize, R.J.; Jaehnig, K.P. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1988. Contract AC02-76CH03073. 17p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015863/JAW.

The use of charge exchange spectrocopy to determine plasma rotation speeds and ion temperature is complicated by the energy dependence of the excitation cross sections. The Doppler-broadened spectral line shape is distorted by the relative velocity between the neutral hydrogen atoms of the injected beam and impurity ions. The asymmetric nature of the energy dependence of this cross section causes a non-motional shift of the line center and

a non-thermal change in the line width. These effects vary with the angles between the beam direction, rotation velocity direction, and direction of the viewing sightline. When viewing two neutral beams at different angles on TFTR, the two measurements of v/sub phi/(r) show discrepancies about 20 to 30% with each other. The calculation of the spectral intensity profiles, using the excitation rates available, overcorrects these discrepancies and indicates the need for better excitation coefficients. 10 refs., 5 figs.

50117 **(PPPL—2540) High beta, sawtooth-free tokamak operation using energetic trapped particles.** White, R.B.; Bussac, M.N.; Romanelli, F. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1988. Contract AC02-76CH03073. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015862/JAW.

It is shown that a population of high energy trapped particles, such as that produced by ion cyclotron heating in tokamaks, can result in a plasma completely stable to both sawtooth oscillations and the fishbone mode. The stable window of operation increases in size with plasma temperature and with trapped particle energy, and provides a means of obtaining a stable plasma with high current and high beta. 13 refs., 2 figs.

50118 **(PPPL—2541) H/sub α/ studies on TFTR.** Heifetz, D.B.; Ehrhardt, A.B.; Ramsey, A.T.; Dylla, H.F.; Budny, R.; McNeill, D.; Medley, S.; Ulrickson, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1988. Contract AC02-76CH03073. 11p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015861/JAW.

H/sub α/ emission is a useful indicator of hydrogen ionization since the energy required to excite hydrogen to the n = 3 level is approximately the same as to ionize the hydrogen atom. Other aspects of recycling, such as plasma scrape-off parameters, wall particle fluxes, and wall retention rates can be inferred from spatial distributions of H/sub α/ emission. There are two H/sub α/ diagnostics on TFTF observing the inner limiter: a relatively calibrated wide-angle TV camera, and the absolutely calibrated HAIFA diagnostic, both viewing the inner limiter. H/sub α/ observations by these instruments have been analyzed using the DEGAS neutral transport code. The core recycling rate, and ion and neutral particle limiter fluxes, have been deduced from the calculations. The results are very sensitive to the ion flux distribution, and therefore also provide information on the plasma scrape-off conditions. A survey was made of over 500 TFTR discharges. H/sub α/ emission appears to increase in proportion to {bar n}/sub e/². The ratio of core ionization to average H/sub α/ emission was calculated to be roughly constant over a large range of discharges. 9 refs., 4 figs., 1 tab.

50119 **(PPPL—2543) A proposed method for reducing the sticking constant in muon catalyzed fusion.** Kulsrud, R.M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1988. Contract AC02-76CH03073. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015822/JAW.

We present a method of reducing the effective sticking coefficient involving reacceleration of the Heμ ion-by-ion cyclotron resonance. It is necessary to work with the target D–T in solid or liquid form, and the target has to be divided into many thin rods or pellets of order 100 microns in radius. The idea is to impose a magnetic field and a rotating electric field. A balance is achieved between drag in the rods or pellets and acceleration in the region between, so that the Heμ ion is held at a constant velocity until stripping occurs. Although stripping is greatly reduced, the idea is not practical as it stands because of the large alpha particle heat produced in the target. 2 refs., 3 figs., 2 tabs.

50120 **(PPPL—2545) Neoclassical tearing modes in a tokamak.** Hahm, T.S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1988. Contract AC02-76CH03073. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015823/JAW.

Linear tearing instability is studied in the banana collisionality regime in tokamak geometry. Neoclassical effects produce significant modifications of Ohm's law and the vorticity equation so that the growth rate of tearing modes driven by Δ′ is dramatically reduced compared to the usual resistive MHD value. Consequences of this result, regarding the presence of pressure-gradient-driven neoclassical resistive interchange instabilities and the evolution of magnetic islands in the Rutherford regime, are discussed. 10 refs.

50121 **(PPPL—2546) H/sub α/ photon yield in fuelling of tokamaks.** McNeill, D.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1988. Contract AC02-76CH03073. 20p. (CONF-880512—11). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015824/JAW.

From 8. international conference on plasma surface interactions in controlled fusion devices; Julich, F.R. Germany (2 May 1988).

The number of H/sub α/ photons emitted per entering particle is examined for three types of fueling in tokamaks: wall and limiter efflux, gas puff, and solid pellet injection. These sources correspond to greater involvement of heavy particles in the breakup of entering molecules and to an increasing degree of thermodynamic equilibrium in the radiating zone. The effect of wall absorption and charge exchange on the photon yield in normal tokamak discharges is examined with a molecular influx model. The emission from a perturbing gas puff is discussed qualitatively as an extension to this model. The photon yield from injected pellets corresponds to a limit of extremely high neutral influx and is estimated with a simple hydrodynamical model and measured pellet cloud parameters. 23 refs., 4 figs., 1 tab.

50122 **(PPPL—2547) Modeling of the sawtooth instability in tokamaks using a current viscosity term.** Ward, D.J.; Jardin, S.C. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1988. Contract AC02-76CH03073. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015825/JAW.

We propose a new method for modeling the sawtooth instability and other MHD activity in axisymmetric tokamak transport simulations. A hyper-resistivity (or current viscosity) term is included in the mean field Ohm's law to describe the effects of the three-dimensional fluctuating fields on the evolution of the inverse transform, q, characterizing the mean fields. This term has the effect of flattening the current profile, while dissipating energy and conserving helicity. A fully implicit MHD transport and 2-D toroidal equilibrium code has been developed to calculate the evolution in time of the q-profile and the current profile using this new term. The results of this code are compared to the Kadomtsev reconnection model in the circular cylindrical limit. 17 refs., 8 figs.

50123 **(PPPL—2549) Three-dimensional plasma equilibrium near a separatrix.** Reiman, A.H.; Pomphrey, N.; Boozer, A.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1988. Contract AC02-76CH03073. 25p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015827/JAW.

The limiting behavior of a general three-dimensional MHD equilibrium near a separatrix is calculated explicitly. No expansions in β or assumptions about island widths are made. Implications of the results for the numerical calculation of such equilibria, are discussed, as well as for issues concerning the existence of three-dimensional MHD equilibria. 16 refs., 2 figs.

50124 **(UCRL—97044) Time-resolved x-ray conversion efficiencies of laser-heated plasmas.** Ze, F.; Kauffman, R.L.; Lasinski, B.; Suter, L.; Langer, S.; Kornblum, H.; Tietbohl, G.; Thiessen, T.; Montgomery, D.; Drake, R.P.; Campbell, E.M. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 12p. (CONF-880364—33). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015456/JAW.

From 7. topical conference on high temperature plasma diagnostics; Napa, CA, USA (13 Mar 1988).

Experiments to obtain time-resolved, soft x-ray emission from laser-driven plasmas are succinctly described. The spectra (0.19 keV ≦ hν 1.3 keV) at various times have been deconvolved and energy-integrated to obtain time-resolved yields from Au disk targets. The temporal profiles of the total thermal x-ray output power follow the overall laser temporal shape but do not show the

high frequency fluctuation observed in the laser pulse. The behavior of the ratio of the instantaneous x-ray yields over the laser absorption is studies. The studies were done at the LLNL Nova laser facility. Single-pulse and pulses in picket fence configuration were used to heat gold targets. 6 refs., 4 figs.

50125 **(UCRL—98417) K-alpha fluorescence for characterizing Au M-band emission.** Phillion, D. (Lawrence Livermore National Lab., CA (USA)). Mar 1988. Contract W-7405-ENG-48. 20p. (CONF-880364—). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015455/JAW.

From 7. topical conference on high temperature plasma diagnostics; Napa, CA, USA (13 Mar 1988).

The reason for using a fluorescer to measure the energy in a spectral band rather than simply measuring the spectrum directly is that the fluorescer integrates not only over the x-ray energy, but also over angle. It is this average that one is interested in, one measurement takes the place of many. Greater accuracy is also expected. However, the number of fluorescent photons per steradian is usually drastically less than the number of exciting x-ray photons per steradian. This is because of several factors: first, for the low-Z fluorescers we used, the fluorescence efficiency was small. Second, the fluorescer subtended only a small solid angle as seem from the source. This was necessary to allow access to the irradiating beams and lines-of-sight for the diagnostics. Last, beryllium filter reduced the x-ray flux upon the fluorescer and re-absorption of the fluorescence reduced the efficiency still further. The net result was that, in terms of photons/sr, the fluorescence signal was only 0.05% as intense as the total terms Au M-band flux above the fluorescer K-edge. The spectrograph looking at the fluorescence did not look directly at the laser-irradiated spot and did not see the coronal plasma until it had moved out many hundreds of microns. Even so, many gold lines were strongly visible. 6 figs., 2 tabs.

50126 **(UCRL—98776) Overview of the Lawrence Livermore National Laboratory.** Batzel, R.E. (Lawrence Livermore National Lab., CA (USA)). May 1988. Contract W-7405-ENG-48. 58p. (CONF-8806192—1). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013811/JAW.

From Lebedev Physical Institute meeting; Moscow, USSR (6 Jun 1988).

Lawrence Livermore National Laboratory (LLNL) is described in general terms: founded in 1952 by Drs. Teller and Lawrence as a national resource; dedicated to the security of the U.S.; facilities at Livermore., Site 300 and in Nevada; the 1988 operating budget is about {dollar+–sign}0.9B; employees approximately 8100. The evolution from the original nuclear weapons and magnetic fusion programs to biomedical, energy and other defense programs is discussed. Top level resource allocation, education level and population growth of personnel is presented. No specific weapons programs are mentioned. The general research capabilities of the inertial confinement fusion and atomic vapor laser isotope separation facilities are generally described. No specific experiments or processes are discussed. The major features of the advanced test accelerator and wiggler amplifier are described along with the gain measurements recently press-released. The experimental test accelerator as rebuilt for free electron laser heating of the Alcator{endash}C Tokamak is described. The relationship of this experiment to the international Tokamak design effort involving the USSR is discussed.

50127 **Measurement of the resistivity in a partially degenerate, strongly coupled plasma.** Shepherd, R.L.; Kania, D.R.; Jones, L.A. (University of Michigan, Department of Nuclear Engineering, Ann Arbor, Michigan 48109). *Physical Review Letters;* **61**: No. 11, 1278-1281(12 Sep 1988).

Plasmas with densities of 6 x 10/sup 22/e/cm^3 and temperatures of 10 eV have been created by means of capillary discharge. These parameters indicate that the plasmas are partially degenerate and strongly coupled. By measuring the size of the plasma, the current, and the voltage, one can infer the resistivity of the plasma and compare it with calculated values from various transport theories. The results of this experiment show that theories that do not accurately model the complete electron-ion interaction within this regime can be inaccurate by as much as a factor of 200.

50128 **Absolute broadband calibration procedure for infrared heterodyne receivers.** Bennett, C.A.; Richards, R.K.; Hutchinson, D.P. (University of North Carolina at Asheville, Physics Department, Asheville, North Carolina 28814). *Applied Optics;* **27**: No. 16, 3324-3325(15 Aug 1988).

A dual-channel low-noise heterodyne receiver is presented as part of a development effort to build a carbon dioxide laser-based Thomson scattering alpha particle diagnostic for a burning plasma experiment./aip/

50129 **Dielectronic recombination in the average-atom model.** More, R.M.; Zimmerman, G.B.; Zinamon, Z. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *AIP (American Institute of Physics) Conference Proceedings;* **168**: No. 1, 33-41(1 Aug 1988). (CONF-870919—).

From 6. topical conference on atomic processes in plasmas; Santa Fe, NM, USA (28 Sep 1987).

We formulate a method to add dielectronic recombination to the average-atom mode without conflict with the principle of detailed balance. The essential ingredient in this extended average atom model is a treatment of strong correlations of electron populations induced by the dielectronic attachment process.

50130 **VUV laser absorption spectrometer system for measurement of H^0 density and temperature in a plasma.** Stutzin, G.C.; Young, A.T.; Schlachter, A.S.; Stearns, J.W.; Leung, K.N.; Kunkel, W.B.; Worth, G.T.; Stevens, R.R. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Review of Scientific Instruments;* **59**: No. 8, 1363-1368(Aug 1988).

A system to determine the density and temperature of ground-state hydrogen atoms in a hydrogen plasma by measurement of the absorption of Lyman-beta or Lyman-gamma radiation is described. The Lyman-series radiation is generated by resonant four-wave sum-frequency mixing in mercury vapor. A wide range of hydrogen atom densities can be measured by employing these two transitions. A sample measurement on a H^- ion-source discharge is presented. Extensions to Lyman-alpha and other vacuum-ultraviolet wavelengths are discussed.

50131 **Four-frame gated optical imager with 120-ps resolution (invited).** Young, P.E.; Hares, J.D.; Kilkenny, J.D.; Phillion, D.W.; Campbell, E.M. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, California 94550). *Review of Scientific Instruments;* **59**: No. 8, 1457-1460(Aug 1988).

In this article we describe the operation and applications of a framing camera capable of four separate two-dimensional images with each frame having a 120-ps gate width. Fast gating of a single frame is accomplished by using a wafer image intensifier tube in which the cathode is capacitively coupled to an external electrode placed outside of the photocathode of the tube. This electrode is then pulsed relative to the microchannel plate by a narrow (120-ps), high-voltage pulse. Multiple frames are obtained by using multiple gated tubes which share a single bias supply and pulser with relative gate times selected by the cable lengths between the tubes and the pulser. A beam-splitter system has been constructed which produces a separate image for each tube from a single scene. Applications of the framing camera to inertial confinement fusion experiments are discussed.

50132 **In situ dye laser calibration for Thomson scattering diagnostics.** Rasmussen, D.A.; Kindsfather, R.R.; Thomas, C.E.; Gormley, R.P.; Painter, S.L. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Review of Scientific Instruments;* **59**: No. 8, 1464-1466(Aug 1988).

The standard laser Thomson scattering calibration technique involves the convolving of density and wavelength response calibrations. This usually includes an in situ Rayleigh scattering from neutral gas for an absolute density calibration at the laser wavelength. In addition, a spectral calibration (i.e., a National Bureau of Standards traceable lamp and white reflective plate) is required to determine the relative wavelength channel responses for the combination of collection optics, spectrometers, and associated detectors.

This technique involves a considerable amount of time and effort in two-dimensional scattering systems because of the number of spectrometers/detectors and the large range of scattering and collection angles. An alternative technique employing a nominal 40-mJ, small-divergence tunable dye laser substituted into the Thomson scattering laser beam path is proposed. Rayleigh scattering (from ~10-Torr H_2) measurements are made at a high repetition rate (1—10 Hz) while the dye laser output wavelength is scanned. This includes in one step the in situ density and channel response calibrations.

50133 **Multipoint Thomson scattering diagnostic for DIII-D.** Hsieh, C.L.; Chase, R.; DeBoo, J.C.; Evanko, R.G.; Gohil, P.; Snider, R.T.; Stockdale, R.E. (General Atomics, San Diego, California 92138). *Review of Scientific Instruments;* **59**: No. 8, 1467-1469(Aug 1988).

The multipoint Thomson scattering diagnostic for DIII-D has been in operation since early 1987. Its capability of measuring electron temperatures as low as 50 eV at densities of a few times 10^{13} cm^{-3} and a spatial resolution of 1.4 cm in the plasma edge region has been essential in the study of H-mode plasmas. The major components of the diagnostic system consist of a 10-J ruby laser, many stages of funnel-shaped beam baffles, stacks of razor blades for viewing and stray light dumps, two wide-angle lenses for the collection of scattered light through reentrant window ports with protection shutters, 88 fiber bundles 15 m in length for light transmission to an f/1.9 spectrometer, an intensified CCD camera system capable of single-photon detection, and a VAX computer for hardware control and data processing. The input end of the fiber bundle is made demountable so the view locations can be reconfigured to optimize the spatial resolution for the plasma region of interest.

50134 **H/sub α/ laser fluorescence diagnostic on the Tara Tandem Mirror experiment.** Guss, W.C.; Yao, X.Z.; Pocs, L.; Mahon, R.; Casey, J.; Post, R.S. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Review of Scientific Instruments;* **59**: No. 8, 1470-1472(Aug 1988).

A laser fluorescence diagnostic has been used for measuring the neutral hydrogen density in the central cell of the Tara thermal barrier tandem mirror. Experiments have been performed using laser-induced, resonance fluorescence detection of H/sub α/ (6563-A) radiation. Measurements were made at a number of radial positions with 1-cm resolution, from the magnetic axis to near the plasma limiter. Stray laser light contributions to the signal were eliminated with a double-pulse technique. For comparison, the chord-averaged plasma H/sub α/ radiation was analyzed under the identical conditions for which laser fluorescence data were taken.

50135 **Double-pulse Nd:glass laser system for Thomson scattering diagnosis of high-temperature plasmas.** Dooling, J.C.; York, T.M. (The Pennsylvania State University, University Park, Pennsylvania 16802). *Review of Scientific Instruments;* **59**: No. 8, 1473-1475(Aug 1988).

Beam properties of a twice Q-switched Nd:glass laser operated at 1053 and 527 nm have been examined with respect to energy, pulse width, divergence, and conversion efficiency at a pulse separation of 75 μs. Q switching occurred twice within a flashlamp burst (FWHM: 160—175 μs). Maximum IR energies of 24 joules per pulse (Jpp) were measured with pulse widths of 25 and 40 ns and divergence values of 0.6 and 0.7 mrad for the first and second pulses, respectively. Maximum second-harmonic energies of 14 J (single pulse) and 4 Jpp were measured with peak power-density conversion efficiencies of 45% and 30%. Use of this laser at 1053 nm, in conjunction with generation III GaAs detectors, offers improvement over current source/detection systems (ruby/S-20) for diagnosis of high-temperature plasmas (T/sub e/ >10 keV).

50136 **Fluorescence measurements of the M-band photon emission from a laser-irradiated gold disk.** Phillion, D.W.; Kauffman, R.L.; Kornblum, H.N. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Review of Scientific Instruments;* **59**: No. 8, 1476-1478(Aug 1988).

Gold M-band x rays with energies above the sulfur K edge of 2.472 keV create sulfur K/sub α/ fluorescence with a quantum efficiency of 8.1%. The sulfur fluorescer was a 600 x 1500-μm rectangle about 1100 μm from the gold plate. It was 25 μm of C_6H_4S plastic shielded by 50 μm of beryllium. The absolute brightnesses of both the M-band spectrum and of the fluorescence line were measured by separate spectrographs. The spectrograph measuring the fluorescence did not have a direct line of sight to the hot gold. These measurements were made with 3512-A laser light irradiating the gold plate for 1 ns over a number of intensities between 2×10^{14} and 10^{15} W/cm^2.

50137 **Atomic hydrogen density measurements in an ion source plasma using a VUV absorption spectrometer.** Stutzin, G.C.; Young, A.T.; Schlachter, A.S.; Stearns, J.W.; Leung, K.N.; Kunkel, W.B.; Worth, G.T.; Stevens, R.R. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Review of Scientific Instruments;* **59**: No. 8, 1479-1481(Aug 1988).

A system to determine the density and temperature of ground-state hydrogen atoms in a plasma by vacuum ultraviolet laser-absorption spectroscopy is described. The continuous tunability of the spectrometer allows for analysis at any of the Lyman transitions. The narrow bandwidth of the laser source allows for the accurate determination of the hydrogen absorption line shape and, hence, the translational temperature. The utility of the system is exemplified by data obtained on an ion source plasma. The measurements show the quality of the data as well as illustrating the behavior of these sources under varying discharge conditions.

50138 **Time-resolved visible spectroscopy of laser-produced lithium plasmas.** Bailey, J.; Tisone, G.C.; Hurst, M.J.; Morrison, R.L.; Bieg, K.W. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **59**: No. 8, 1485-1487(Aug 1988).

We have measured time-resolved visible spectra emitted from a plasma formed when the output from a dye laser irradiates solid lithium. Such a plasma has potential as a source of lithium ions for ion-driven inertial confinement fusion, and it also provides a useful source for developing diagnostics. The laser delivered 0.5 J onto a 2—7-mm-diam spot, with a 900-ns pulse length. Experiments were performed with the wavelength tuned to the Li I 2s—2p resonance line at 6708 A and off resonance at 6728 A. The target was a 500—1000-A-thick Li film, vacuum evaporated in situ onto a substrate. The light from the plasma was coupled into the entrance slit of a 1-m Czerny—Turner spectrograph, and the output from the spectrograph was focused onto the input slit of a streak camera. The electron density was obtained from Stark-broadened widths of Li I 2p—4d, 2p—5d, and 2p—4s, and H I 2p—4d. An irradiance of 2×10^9 W/cm^2 at 6708 A resulted in a peak electron density of 3.9×10^{17} cm^{-3}. The density decreased at lower irradiance, with an intensity threshold of 5×10^8 W/cm^2 for producing an ionized plasma. The threshold for producing a plasma was higher with the laser tuned off resonance, although high-density lithium plasmas could still be formed at relatively low laser irradiance.

50139 **Measurements of neutral density profiles on the TEXT tokamak.** Boedo, J.A.; Bengtson, R.D.; Ouroua, A.; Valanju, P.M. (Physics Department and Fusion Research Center, The University of Texas at Austin, Austin, Texas 78712). *Review of Scientific Instruments;* **59**: No. 8, 1494-1496(Aug 1988).

Neutral density profiles are measured in the outer third of the plasma of the TEXT tokamak in conjunction with ion temperature measurements using the far line wings of a H/sub α/ profile. The advantage of this technique is that it does not require a radial inversion of the data to obtain a measure of the local neutral density. The ion temperature profiles are compared with the results from a neutral particle analyzer, and the neutral profiles with the results of a numerical code which solves a system of coupled linear equations describing particle transport from a neutral source.

50140 Field-dependent dipole matrix elements and their application to the calculation of plasma-broadened line profiles. Mancini, R.C.; Hooper C.F. Jr. (Department of Physics, University of Florida, Gainesville, Florida 32611). *Review of Scientific Instruments;* **59**: No. 8, 1512-1514(Aug 1988).

We have computed field-dependent wavefunctions and dipole matrix elements for hydrogenic ions in the presence of a uniform electric field; we present the results for transitions connecting the ground and excited states. As an application we use these elements to compute Stark-broadened static line profiles and compare with similar ones that use field-independent matrix elements. The line-shape sensitivity to the use of field-dependent matrix elements is discussed.

50141 Utilization of charge exchange recombination spectroscopy for the study of metallic ion transport in TFTR. Knize, R.J.; Fonck, R.J.; Howell, R.B.; Hulse, R.A.; Jaehnig, K.P. (Princeton Plasma Physics Laboratory, Princeton University, P.O. Box 451, Princeton, New Jersey 08544). *Review of Scientific Instruments;* **59**: No. 8, 1518-1520(Aug 1988).

Charge exchange recombination spectroscopy has been used to observe transitions originating from hydrogen-, helium-, and lithiumlike charge states of medium-Z metallic impurities in TFTR. The temporal and spatial densities of these ions were measured in ohmic and neutral beam heated plasmas. These preliminary results agree with predictions of a transport code.

50142 Corrections to charge exchange spectroscopic measurements in TFTR due to energy-dependent excitation rates. Howell, R.B.; Fonck, R.J.; Knize, R.J.; Jaehnig, K.P. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Review of Scientific Instruments;* **59**: No. 8, 1521-1523(Aug 1988).

The use of charge exchange spectroscopy to determine plasma rotation speeds and ion temperature is complicated by the energy dependence of the excitation cross sections. The Doppler-broadened spectral line shape is distorted by the relative velocity between the neutral hydrogen atoms of the injected beam and impurity ions. The asymmetric nature of the energy dependence of this cross section causes a nonmotional shift of the line center and a nonthermal change in the linewidth. These effects vary with the angles between the beam direction, rotation velocity direction, and direction of the viewing sightline. When viewing two neutral beams at different angles on TFTR, the two measurements of v/sub phi/(r) show discrepancies of about 20%—30% with each other. The calculation of the spectral intensity profiles using the available excitation rates overcorrects these discrepancies and indicates the need for better excitation coefficients.

50143 Multichordal visible/near-UV spectroscopy on the DIII-D tokamak. Seraydarian, R.P.; Burrell, K.H.; Groebner, R.J. (GA Technologies Inc., San Diego, California 92138). *Review of Scientific Instruments;* **59**: No. 8, 1530-1532(Aug 1988).

A pair of visible/near-UV spectrometers with eight viewing chords apiece have been installed on the DIII-D tokamak. Each system views a neutral heating beam and can acquire up to 250 complete spectra from each chord with 5—20-ms time resolution. Each viewing chord covers 60 A with 0.27-A spectral resolution, and the chords span about (2)/(3) of the plasma's full width. By viewing Doppler-broadened spectral lines from charge exchange recombination (CER) reactions between beam neutrals and plasma ions, ion temperatures up to 4 keV have been measured, and the bulk Doppler shift of these same lines has yielded plasma rotation velocities up to 200 km/s. The constancy of temperature on a magnetic flux surface and the rigid rotor model of a flux surface have been confirmed. These instruments have also been used to measure the neutral beam deposition profile, and preliminary experimental results agree with theoretical calculations of the beam deposition profile.

50144 Laser induced fluorescence measurements in the Pisces plasma (abstract). Rettig, C.L.; Peebles, W.A.; Luhmann N.C. Jr.; Gohil, P. (Institute for Plasma and Fusion Research, University of California, Los Angeles, California 90024). *Review of Scientific Instruments;* **59**: No. 8, 1536-1536(Aug 1988).

By resonantly exciting neutrals in a cool plasma, the local neutral density and possibly ion temperature can be measured. If the neutrals are pumped by a laser with an intensity sufficient to saturate the transition, then observation of the fluorescence at the same wavelength will show an enhancement in the spontaneous emission during the laser pulse. The pump radiation changes the excited level population distribution in such a way that theoretical modeling can extract the ground-state population from the measured enhancement. Here, a 350-kW flash-lamp pumped dye laser is being used at 656 and 481 nm to pump the Balmer alpha and beta lines of hydrogen in the continuous Pisces plasma which simulates the edge using a tokamak. The fluorescence is observed with a photomultiplier tube through a narrow-band interference filter. Great care has been taken to reduce stray light to a negligible level. Data will be presented taken from plasmas with densities between 10^{11} and 10^{13} cm^{-3} and electron temperatures between 5 and 25 eV. In addition, by spectrally resolving the fluorescence, local ion temperatures can be inferred from Doppler broadening. However, actual temperatures measured are close to the resolution limit of the spectrometer. Future work could include these temperature measurements in the edge region of a tokamak. This work was supported by the U.S. DOE Contract No. DE-F03-86-ER-53225.

50145 X-mode scattering for the measurement of density fluctuations on TFTR (invited). Bretz, N.; Efthimion, P.; Doane, J.; Kritz, A. (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08544). *Review of Scientific Instruments;* **59**: No. 8, 1538-1543(Aug 1988).

Most microwave scattering measurements in tokamaks are done with the polarization of the incident radiation approximately parallel to the toroidal field (ordinary mode) and at a frequency which is sufficiently above the plasma frequency ω/sub p//sub e/ that refraction effects are small. However, as confinement devices get hotter, drift wave turbulence is expected to occur at longer wavelengths. In order to observe density fluctuations associated with these phenomena with good spatial resolution, the ideal probe wavelength λ/sub i/ is near or beyond the ordinary cutoff at λ/sub i/ = 2πc/ω/sub p//sub e/. As a result, we have considered the propagation and scattering of the extraordinary (X) mode where the incident polarization is nearly perpendicular to the confining fields and where the cutoff density is significantly higher than in the ordinary mode. We have modeled the propagation of the X mode in a tokamak field geometry and shown that the polarization typically remains perpendicular to the local field along the ray path, simplifying the interpretation of the scattering results. We have calculated the single-particle cross section and give a formula for X-to-X-mode scattering. An apparatus for carrying out these measurements on TFTR at λ/sub i/ = 0.5 cm will be described. For B/sub T/ = 5.0 T, the X-mode cutoff density in this case is 1.5 x 10^{14} cm^{-3}, so that a major part of the operating density range can be studied by this technique.

50146 High-resolution multichannel interferometric measurement of sawtooth density-pulse propagation (invited). Kim, S.K.; Brower, D.L.; Peebles, W.A.; Luhmann N.C. Jr. (Institute of Plasma and Fusion Research, University of California, Los Angeles, California 90024). *Review of Scientific Instruments;* **59**: No. 8, 1550-1555(Aug 1988).

A unique high-resolution far-infrared multichannel interferometer system has been developed and successfully operated on the Texas Experimental Tokamak. Two sets of cylindrical parabolic mirrors are employed to expand both the local oscillator and probe beams in one dimension to cover the plasma cross section accessible through the vertical ports. A maximum of 29 mixers is configured on a linear array which provides a spatial resolution of 1.5 cm. The overall density resolution is ≦5 x 10^{10} cm^{-3} with a time response of 50 μs. The high resolution of the system permits detailed measurements of small-amplitude fine-structure density effects such as MHD activity during disruptions and sawteeth. Detailed observa-

tions of density-pulse propagation processes induced from sawtooth internal disruptions are described. Analysis of sawtooth density-pulse propagation measurements based on a diffusive model has led to a direct estimate of the internal electron particle diffusion coefficient.

50147 **CO_2 laser Thomson scattering diagnostic for fusion product alpha particle measurement.** Richards, R.K.; Bennett, C.A.; Fletcher, L.K.; Hunter, H.T.; Hutchinson, D.P. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Review of Scientific Instruments;* 59: No. 8, 1556-1558(Aug 1988).

A description of a CO_2 laser Thomson scattering diagnostic for fusion product alpha particles is presented. Scattering calculations based on CIT plasma parameters are presented and compared to previous work based on TFTR parameters. System components are described and a proof-of-principle test in a nonburning plasma is discussed.

50148 **Application of FIR heterodyne detection to collective scattering measurements of tokamak microturbulence.** Brower, D.L.; Peebles, W.A.; Kim, S.K.; Luhmann N.C. Jr. (Institute of Plasma and Fusion Research, University of California, Los Angeles, California 90024 TEXT Group, Fusion Research Center, University of Texas, Austin, Texas 78712). *Review of Scientific Instruments;* 59: No. 8, 1559-1561(Aug 1988).

Multichannel collective scattering of far-infrared (FIR) laser radiation is employed on the TEXT tokamak to investigate small-scale turbulent density fluctuations. A twin-frequency optically pumped FIR laser operating at 1222 μm (≃20 mW) and a difference frequency $\Delta\omega$/sub IF//$2\pi\simeq$1 MHz is used for the source and local oscillator beams. This permits heterodyne detection of the frequency-shifted scattered radiation which is necessary to determine wave propagation direction of plasma density fluctuations. The need for heterodyne versus homodyne detection is demonstrated. Such a diagnostic capability has allowed preliminary identification of the ion pressure-gradient-driven instability (whose most notable signature is that of turbulent fluctuations propagating in the ion diamagnetic drift direction) which is potentially responsible for saturation of the global energy confinement time with increasing density in tokamak plasmas.

50149 **Two-color interferometer system for Alcator C-MOD.** Irby, J.H.; Marmar, E.S.; Sevillano, E.; Wolfe, S.M. (M.I.T. Plasma Fusion Center, Cambridge, Massachusetts 02139). *Review of Scientific Instruments;* 59: No. 8, 1568-1570(Aug 1988).

High densities with sharp, fast rising profiles are expected during pellet injection in Alcator C-MOD. Consideration of interferometer systems other than far infrared will be needed to avoid refractive effects and make profile measurements during pellet injection possible. CO_2 wavelengths are proving to be the most interesting from the standpoint of density measurements, with the necessary vibration subtraction provided by a coaxial He:Ne system. We will describe the two-color interferometer as it is presently designed and present results from simulations made of the system to determine noise levels, minimum measurable density, and optimal number and location of chords. Ray tracing results both with and without pellet injection will be compared. Possible fringe counting schemes will also be discussed.

50150 **Watt-level millimeter-wave monolithic diode-grid frequency multipliers.** Hwu, R.J.; Jou, C.F.; Luhmann N.C. Jr.; Lam, W.W.; Rutledge, D.B.; Hancock, B.; Lieneweg, U.; Maserjian, J.; Streit, D.C. (Department of Electrical Engineering, University of California, Los Angeles, Los Angeles, California 90024). *Review of Scientific Instruments;* 59: No. 8, 1577-1579(Aug 1988).

Watt-level cw solid-state sources in the millimeter-wave region are needed for plasma diagnostics. Monolithic metal-grid arrays containing in excess of 1000 Schottky diodes have produced watt-level output at 66 GHz in a doubler configuration, in excellent agreement with the large-signal predictions of the frequency multiplication. Current efforts are concentrated on fabricating and developing arrays of a novel barrier-intrinsic-N^+ (BIN) diode which promise increased performance in a tripler configuration. Initial tests will be made for a configuration where a tripling efficiency of 35% at an output frequency of 100 GHz is predicted. Eventual goals are monolithic BIN diode grids operating at 1 THz.

50151 **Two-color interferometry for fusion plasma diagnostics.** Lehecka, T.; Peebles, W.A.; Luhmann N.C. Jr.; Carlstrom, T.N. (Institute of Plasma and Fusion Research, University of California, Los Angeles, California 90024). *Review of Scientific Instruments;* 59: No. 8, 1580-1581(Aug 1988).

Radial view interferometers on large fusion devices have experienced difficulty in compensating for large vibration-induced phase shifts. This compensation has previously been achieved using common path visible or near infrared interferometers. However, the high rate of phase change observed by the compensation interferometer combined with deterioration of reflecting surfaces located close to the harsh plasma environment limit the resolution and usefulness of such systems. This article describes laboratory tests of a vibration-compensating interferometer that operates at two wavelengths of the CO_2 laser: 9.2 and 10.6 μm. It is particularly well suited for application to CIT or other devices with either high density or large plasma dimensions.

50152 **Development and design of a nonmagnetic and nonconducting interferometer optical system.** Burns, S.R.; Peebles, W.A.; Brooksby, C.A.; Rice, B.W. (Institute for Plasma and Fusion Research, Los Angeles, California 90024). *Review of Scientific Instruments;* 59: No. 8, 1582-1584(Aug 1988).

The use of a 0.185-mm far-infrared (FIR) laser interferometer on MTX required the design and development of optical components which are nonmagnetic and nonconducting. This arose from the requirement that the path length of the FIR interferometer not change by more than (1)/(50) of a wavelength during the half-second plasma pulse. The time-dependent stray magnetic fields, 7000—400 G over the optical table area, generate strong eddy current forces which would produce path length changes greater than the design criteria if the components were metallic. Thus, the optical tower which supports the optical tables, one above and one below the tokamak, is a composite structure of 304 stainless steel and G-10 fiberglass. Also, the optical table and components are made of G-10 with a minimum of 304 stainless-steel parts to avoid eddy current forces and maintain structural rigidity. The design criteria of the optical components are discussed with a comparison of suitable materials. A discussion of the process which was developed to fabricate plastic parabolic beam expanding and focusing mirrors with a metallized reflective surface is presented. The mixer and electronics enclosure design minimizes eddy current forces by use of printed circuit board material while maintaining excellent EMI/RFI shielding.

50153 **Density profile reconstructions from 2-D interferometric data on Microtor using novel tomographic analysis techniques (abstract).** Howard, J.; Doyle, E.J.; Reibeiz, G.; Savage R.L. Jr.; Peebles, W.A.; Luhmann N.C. Jr. (Institute for Plasma and Fusion Research, University of California, Los Angeles, California 90024). *Review of Scientific Instruments;* 59: No. 8, 1592-1592(Aug 1988).

Plasma tomographic reconstructions are subject to aliasing ambiguity as a result of the limited angular and radial sampling rates for the line-integrated data. The two-view interferometer installed on the Microtor tokamak yields unambiguous information, specifically, a collection of six low-order alias-free moments of the 2-D electron density distribution. The unspoiled coefficients can be related to physically intuitive quantities and so yield information pertinent to the equilibrium and dynamical behavior of the plasma column. Alternatively, they can be used as constraints for a maximum entropy reconstruction of the source to produce an image free of aliasing artifacts.

50154 **Superthermal electron distribution measurements from polarized electron cyclotron emission (invited).** Luce, T.C.; Efthimion, P.C.; Fisch, N.J. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Review of Scientific Instruments;* 59: No. 8, 1593-1598(Aug 1988).

Measurements of the superthermal electron distribution can be made by observing the polarized electron cyclotron emission. The emission is viewed along a constant magnetic field surface. This simplifies the resonance condition and gives a direct correlation between emission frequency and kinetic energy of the emitting electron. A transformation technique is formulated which determines the anisotropy of the distribution and number density of superthermals at each energy measured. The steady-state distribution during lower hybrid current drive and examples of the superthermal dynamics as the runaway condition is varied are presented for discharges in the PLT tokamak.

50155 **Ion cyclotron emission spectroscopy as an α-particle monitor.** Moses, K.G.; Sperling, J.L.; Dooling, J.C.; Chu, C. (JAYCOR, Plasma Technology Division, Torrance, California 90503). *Review of Scientific Instruments;* 59: No. 8, 1605-1607(Aug 1988).

Since 1981, we have proposed and investigated spectral analysis of the harmonics of ion cyclotron emission (ICE) as a means of monitoring the energy content of α particles confined in a magnetic fusion device. A pair of crown probe antennas have been constructed for TFTR to collect ICE spectra and will be installed on that device in the near future. The design of this ICE spectroscopy system is described. Also, some calculations of ICE electromagnetic fluctuations in the ICRF, due to newborn α particles with a distribution function appropriate to typical fusion reactor parameters, are discussed. The calculated emission spectra are quite distinct from that of blackbody radiation.

50156 **Electron density measurements from cutoff of electron cyclotron emission in the DIII-D tokamak.** Lohr, J. (GA Technologies Inc., San Diego, California 92138). *Review of Scientific Instruments;* 59: No. 8, 1608-1610(Aug 1988).

Cutoff of microwave emission at the second harmonic of the electron cyclotron frequency has been used to infer the local electron density profile in the DIII-D tokamak. Modeling the density profile during the uncontrolled density increase associated with the transition to H-mode operation permits the profile shape factor and line average to be estimated. In special cases, the density fluctuations associated with sawteeth can also be inferred. Independent corroboration of the standard density diagnostics has been performed with this technique.

50157 **Vertical-viewing electron cyclotron emission diagnostic for the DIII-D tokamak.** James, R.; Janz, S.; Ellis, R.; Boyd, D.; Lohr, J. (General Atomics Technologies, Inc., San Diego, California 92138). *Review of Scientific Instruments;* 59: No. 8, 1611-1613(Aug 1988).

The vertical-viewing electron cyclotron emission diagnostic on DIII-D will be used to assess the nonthermal electron distributions resulting from electron cyclotron heating and electron cyclotron current drive experiments. Electron cyclotron emission along a vertical chord is collected using an ellipsoidal focusing mirror and retroreflector (the latter to minimize wall reflections). The emission is then transported ~20 m using a quasioptical transport system composed of eight lenses and three mirrors, and detected between the 2nd and the 10th harmonics by a fast-scanning (40-Hz) Michelson interferometer. The entire system has been aligned using a Gaussian beam simulator and absolutely calibrated in situ using a cold liquid-nitrogen bath. Details of the design, installation, and calibration will be discussed.

50158 **ECE diagnostic for ATF.** Bell, G.L.; Gandy, R.F.; Wilgen, J.B.; Rasmussen, D.A. (Department of Physics, Auburn University, Auburn, Alabama 36849). *Review of Scientific Instruments;* 59: No. 8, 1614-1616(Aug 1988).

Electron cyclotron emission (ECE) from the Advanced Toroidal Facility (ATF) torsatron will allow measurement of plasma electron temperature. For low-field operation (0.95 T) the second harmonic is cut off at a relatively low density; therefore, third-harmonic emission from 67 to 83 GHz is used to yield central electron temperatures. At high-field operation (1.9 T) second-harmonic emission from 82 to 114 GHz is optically thick and can provide T/sub e/(r) information. A vertical view of the saddle-point geometry of the ATF mod B spatial contours provides a line of sight along which the mod B contours are symmetric with respect to flux surfaces. A single horn—lens viewing beam system with a vertical view is designed to cover the entire 67—114-GHz range, providing a spot size on the order of 6 cm. Radiation will be delivered to one of three waveguide mixers by C-band waveguide. Each of the three mixers covers a 16-GHz segment of the emission spectrum, downconverting it to the 2—18-GHz intermediate-frequency band, where it is processed by a 16-channel array of bandpass filters, providing 1-GHz frequency resolution.

50159 **Poloidal field measurements using laser-enhanced attenuation of an energetic lithium beam.** West, W.P.; Thomas, D.M.; Thomas, M.P. (General Atomics, San Diego, California 92138). *Review of Scientific Instruments;* 59: No. 8, 1617-1619(Aug 1988).

The current density profile diagnostic system presently operating on the Texas Experimental Tokamak (TEXT) employs a cw dye laser system to induce fluorescence in a lithium beam injected into the discharge. Systematic effects due to the finite lifetime of the excited state and enhancement of the beam attenuation during laser excitation limit the application of this technique to plasma densities approx. $<1 \times 10^{13}$ cm^{-3}. Laser enhancement of beam attenuation results from the large collisional ionization cross sections of the excited Li 2P state compared to the 2S ground state. This effect is exploited in a new diagnostic scheme which uses the polarization modulation of the present technique, but monitors the enhanced attenuation as opposed to the fluorescence. Detailed modeling indicates that a collinear beams configuration, with a short pulse laser and time-of-flight signal analysis, will provide a measurement of the complete poloidal field profile on TEXT at plasma densities up to 3×10^{13} cm^{-3} with 16-ms averaging times.

50160 **Reflectometry systems for the DIII-D tokamak.** Lehecka, T.; Peebles, W.A.; Luhmann N.C. Jr.; Burns, S.R.; Olson, E.; DIII-D Group. (Institute of Plasma and Fusion Research, University of California, Los Angeles, California 90024). *Review of Scientific Instruments;* 59: No. 8, 1620-1622(Aug 1988).

A seven-channel reflectometer system has been installed on the DIII-D tokamak. This diagnostic will be used to investigate electron density profiles and fluctuations during both L- and H-mode operation. The reflectometer is configured as a narrow-band FM radar system utilizing analog electronics and compound modulation. These techniques have been tested in the laboratory yielding a spatial accuracy of +- 1 cm and temporal resolution of ~1 ms.

50161 **Q-profile measurement in tokamaks using fueling pellets.** Durst, R.D.; Phillips, P.E.; Rowan, W.L. (The Fusion Research Center, The University of Texas at Austin, Austin, Texas 78712). *Review of Scientific Instruments;* 59: No. 8, 1623-1625(Aug 1988).

Fuel pellets ablating in a hot, magnetically confined plasma generate cold, self-luminous filaments which seem to orient themselves along the local magnetic field direction. This distinctive ablation pattern has been used for local measurements of the q profile. In the Texas Experimental Tokamak (TEXT), this technique was investigated experimentally, and the results were compared to other q-profile measurements to examine limits of applicability. It is found that the technique may be applied only to limited regions of the plasma. Although the mechanism which causes the filaments to align along the magnetic field lines is not completely understood, comparisons between this technique and other techniques tend to support its use. Inclination angle profiles for the local magnetic field and q profiles obtained on TEXT by this technique are presented. The q profiles are compared with predictions based on various resistivity models, specifically classical, neoclassical, and q-clamped.

50162 Current density profile determination via polarimetry. Nagatsu, M.; Peebles, W.A.; Luhmann N.C. Jr. (Institute for Plasma and Fusion Research, University of California, Los Angeles, California 90024). *Review of Scientific Instruments;* 59: No. 8, 1626-1628(Aug 1988).

Extensive experimental and numerical studies have been performed to assess the feasibility of polarimeter systems to be installed on a number of devices. The systems employ an amplitude ratio technique similar to that of Soltwisch, with a 45° polarizer angle to divide probe beam equally between two mixer arrays. At present, a nine-channel system has been constructed to perform measurements of central q value and also the current density profile by scanning the entire system. Laboratory test results will be discussed together with installation plans. The system has the advantage that the amplitude ratio is very insensitive to ellipticity, which can be determined from the phase difference between equivalent detector signals. These properties make the polarimeter attractive, especially for high-field, high-density plasmas where the elliptization effects are large. In this case Psi/sub p/ not =const $\lambda^2 \int$n/sub e/B/sub p//sub z/.

50163 Spectroscopic measurement of the poloidal field profile in the TEXT. Wroblewski, D.; Huang, L.K.; Moos, H.W.; Phillips, P.E. (Department of Physics and Astronomy, The Johns Hopkins University, Baltimore, Maryland 21218). *Review of Scientific Instruments;* 59: No. 8, 1632-1634(Aug 1988).

The poloidal field profile in the Texas Experimental Tokamak is determined from the analysis of circular polarization of the forbidden (magnetic dipole) line Ti XVII 3834 A. A high-sensitivity polarimeter measures the difference between right- and left-hand circularly polarized line profiles, a quantity which is directly proportional to the magnitude of the magnetic field component in the direction of observation. The fractional circular polarization smaller than 10^{-3} can be detected, which allows determining the poloidal magnetic field in the center of the plasma with uncertainty as small as 50 G. The instrumentation is relatively simple and inexpensive. Description of the polarimeter and results of measurement of the poloidal field profile and the safety factor on the tokamak axis are presented.

50164 Detection of trapped magnetic fields in a theta pinch using a relativistic electron beam. Leemans, W.P.; Clayton, C.E.; Joshi, C. (Electrical Engineering Department, University of California at Los Angles, Los Angeles, California 90024). *Review of Scientific Instruments;* 59: No. 8, 1641-1643(Aug 1988).

A novel nonperturbative diagnostic is used to infer the existence of trapped magnetic fields in a θ-pinch plasma. A thin beam of 1.5-MeV electrons from a 9-GHz, X-band linear accelerator is injected along the axis of a θ pinch with a period of 6 μs. The electron pulse duration is approximately 1 μs. Without any fill gas, when the θ pinch is fired, only those electrons within +- 50 ns of the second B/sub ext/ = 0 are transmitted. The rest of the electrons are deflected by the solenoidal field, which acts as a strong lens. When the plasma is present even these transmitted electrons at B/sub ext/ = 0 are deflected because the plasma can trap some of the field lines. The magnitude and the scale length of these trapped fields can be estimated from the extent of the deflection.

50165 Heavy-ion beam probe diagnostic systems (invited). Schoch, P.M.; Carnevali, A.; Conner, K.A.; Crowley, T.P.; Forster, J.C.; Hickok, R.L.; Lewis, J.F.; Schatz J.G. Jr.; Hallock, G.A. (Rensselaer Polytechnic Institute, Troy, New York 12180-3590). *Review of Scientific Instruments;* 59: No. 8, 1646-1651(Aug 1988).

Heavy-ion beam probing generally consists of passing a beam of 1^+ ions through a plasma imbedded in a magnetic field. Secondary ions with higher ionization levels are produced by ionizing collisions with the plasma electrons. Detection of the secondary ions with a small-aperture electrostatic energy analyzer allows continuous fluctuation measurements of the plasma density and space potential with both spatial and temporal resolution. Spatial resolution is the order of 0.1 cm^3 and temporal resolution is presently electronics limited to $\sim$1 μs. The energy of the probing beam is determined primarily by the requirement that the secondary ion must escape from the plasma. Typical beam energies extend from 10 to 500 keV. The range of plasma densities that have been investigated is 10^{12} cm^{-3} <n/sub e/< 10^{14} cm^{-3}. At the higher densities, beam attenuation becomes a serious problem. Higher beam energies provide better penetration of the magnetic field, and reduced beam attenuation. Heavy-ion beam probes were first used to measure a coherent density fluctuation on a hollow cathode arc in 1969, and soon afterward to measure the space potential. Since then beam probes have been used to measure the space potential and fluctuations in both density and space potential for plasmas with varying magnetic geometries. There is continuing development work to study the feasibility of using beam probes to measure magnetic fluctuations and magnetic field structure. Sensitivity for measuring density and potential fluctuations is best demonstrated by what is the most sophisticated beam probe to date: the 500-keV system on TEXT.

50166 Operation of an E parallel B end-loss ion spectrometer on the Tara tandem mirror. Casey, J.A.; Horne, S.F.; Irby, J.H.; Post, R.S.; Sevillano, E.; Foote, J.H. (M.I.T. Plasma Fusion Center, MIT, Cambridge, Massachusetts 02139). *Review of Scientific Instruments;* 59: No. 8, 1664-1666(Aug 1988).

An E parallel B end-loss ion spectrometer from the Livermore TMX-U tandem mirror experiment was installed on Tara for high-resolution ion spectroscopy. This diagnostic contains parallel electric and magnetic fields, separating the masses and energies of the ions over 128 collector plates. The ion energy distribution nominally yields confining potentials and parallel ion temperatures. Additional experiments have diagnosed the resonance position of the central cell ion cyclotron heating, rf enhanced losses of high-energy sloshing ions in the axicell ("plug"), and observation of MHD instabilities at higher time resolution (20 kHz).

50167 Heavy-ion beam probe for the Advanced Toroidal Facility. Carnevali, A.; Connor, K.A.; Aceto, S.C.; Lewis, J.F.; Glowienka, J.C.; Shipley, D.; Eberle, C. (Rensselaer Polytechnic Institute, Troy, New York 12180-3590). *Review of Scientific Instruments;* 59: No. 8, 1670-1672(Aug 1988).

Neoclassical theory predicts that radial electric fields develop in plasmas confined in nonaxisymmetric tori and that they strongly influence the confinement in such devices. A heavy-ion beam probe has been planned for the ATF torsatron at Oak Ridge National Laboratory with the primary goal of providing direct measurements of the plasma potential radial profile and thus of the radial electric field. The complex ATF geometry and magnetic field structure present a diagnostic environment more challenging than that found on previous beam probe systems which have operated on tokamaks, mirrors, and bumpy tori. Particular attention has been given to system alignment and control capabilities. Since the probing ion trajectories remain essentially the same with or without the plasma, an in situ calibration scheme using suitable ionization targets is possible. Installation of the complete diagnostic system is planned for 1988.

50168 TFTR epithermal neutron detector system: Recalibration and effect of nonisotropic neutron emission. Hendel, H.W.; Jassby, D.L.; Bosch, H.S.; Barnes, C.W.; Johnson, L.C.; Murphy, T.J.; Nieschmidt, E.B.; Saito, T.; Strachan, J.D.; Tait, G.D.; and others. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey 08543). *Review of Scientific Instruments;* 59: No. 8, 1682-1684(Aug 1988).

The primary TFTR neutron source strength measurement system consists of seven fission detectors previously calibrated with D—D and D—T neutron generators and a ^{252}Cf neutron source inside the TFTR vacuum vessel. A recalibration became desirable because of the addition of major components to the tokamak. The new calibration with the D—D neutron generator in situ is consistent with the detection efficiencies measured in the previous calibrations, within the uncertainties. Effects of the anisotropic emission of the neutron generator, due both to the variation of the differential D—D yield with angle (similar to that from beam—target and beam—beam reactions in the beam-driven TFTR plasma) and to scattering and absorption by the generator heads have been observed.

50169 Relative intensities of 2.5- and 14-MeV source neutrons from comparative responses of U-238 and U-235 detectors. Jassby, D.L.; Hendel, H.W.; Bosch, H. (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 8, 1688-1690(Aug 1988).

The response of polyethylene-moderated U-235 fission counters is only weakly dependent on incident neutron energy, while the response of unmoderated U-238 or Th-232 fission counters increases strongly with energy. A given concentration of D—T neutrons in a mixed DT—DD source results in a unique relative detector response that depends on the parameters R_{14} and R/sub 2.5/, where R_{14} is the ratio of the unmoderated U-238 and moderated U-235 detector efficiencies for a pure 14-MeV neutron source, and R/sub 2.5/ is the corresponding ratio for a pure 2.5-MeV source. We have recently determined R_{14} and R/sub 2.5/ using D—D and D—T neutron generators inside the TFTR vacuum vessel. The results indicate that, for our detector geometry, the ratio of U-238 to U-235 count rates should increase by a factor of about 3 when the fusion neutron source changes from pure D—D to pure D—T. This calibration is being applied to recent TFTR "supershot" data, where the uncollided neutron flux in the post-beam phase contains a high proportion of D—T neutrons from the burnup of D—D tritons.

50170 Measurements with vertically viewing charge exchange analyzers during ion cyclotron range of frequencies heating in TFTR. Kaita, R.; Hammett, G.W.; Gammel, G.; Goldston, R.J.; Medley, S.S.; Scott, S.D.; Young, K.M. (Princeton University Plasma Physics Laboratory, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 8, 1691-1693(Aug 1988).

The utility of charge exchange neutral particle analyzers for studying energetic ion distributions in high-temperature plasmas has been demonstrated in a variety of tokamak experiments. Power deposition profiles have been estimated in the Princeton large torus (PLT) from particle measurements as a function of energy and angle during heating in the ion cyclotron range of frequencies (ICRF) and extensive studies of this heating mode are planned for the upcoming operational period in the tokamak fusion test reactor (TFTR). Unlike the horizontally scanning analyzer on PLT, the TFTR system consists of vertical sightlines intersecting a poloidal cross section of the plasma. A bounce-averaged Fokker—Planck program, which includes a quasilinear operator to calculate ICRF-generated energetic ions, is used to simulate the charge exchange flux expected during fundamental hydrogen heating. These sightlines also cross the trajectory of a diagnostic neutral beam (DNB), and it may be possible to observe the fast ion tail during ^{3}He minority heating, if the DNB is operated in helium for double charge exchange neutralization.

50171 Neutron imaging of inertial confinement fusion targets at Nova. Ress, D.; Lerche, R.A.; Ellis, R.J.; Lane, S.M.; Nugent, K.A. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Review of Scientific Instruments;* **59**: No. 8, 1694-1696(Aug 1988).

Images of the neutron-emitting region of high-yield inertial confinement fusion targets have been obtained with a penumbral coded-aperture imaging system. The major components of the imaging system are the penumbral aperture, neutron detector, alignment hardware, and image reconstruction software. We describe these components and present an example of the neutron imaging results.

50172 Neutron emission time measurements for ICF targets. Lerche, R.A.; Kania, D.R.; Lane, S.M.; Tietbohl, G.L.; Bennett, C.K.; Baltzer, G.P. (University of California, Lawrence Livermore National Laboratory, P. O. Box 5508, L-473, Livermore, California 94550). *Review of Scientific Instruments;* **59**: No. 8, 1697-1699(Aug 1988).

The neutron emission time for laser-driven inertial confinement fusion targets is determined from data recorded with fast neutron and optical detector systems. Two types of neutron detectors are used. Radiation-induced conductivity devices have a 130-ps FWHM response and are sensitive to targets with yields greater than 5 x 10/sup 10/ DT neutrons. They measure the average neutron emission time with a precision of +- 50 ps and are fast enough to measure the neutron production rate within a target core as a function of time. Plastic scintillators coupled to microchannel-plate photomultiplier tubes have a 1.2-ns FWHM response and measure the average neutron emission time with a precision of +- 75 ps for targets with yields greater than 10^8 neutrons. Streak cameras record the incident laser power. Optical fiducial signals that are injected into each detector are used to cross time between the detector systems. Measurements made on 1-mm-diam spherical targets irradiated with 23 kJ of 0.35-μm light delivered in a temporally square 1.1-ns pulse and yielding 10/sup 13/ neutrons show a burn duration greater than 300 ps and an average neutron emission time of about 850 ps.

50173 Rutherford magnetic spectrograph for intense ion beam measurements on PBFA-II. Leeper, R.J.; Stygar, W.A.; Kensek, R.P.; Lee, J.R.; Johnson, D.J.; Lockner, T.R.; Maenchen, J.; Hebron, D.E.; Wenger, D.F. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **59**: No. 8, 1700-1702(Aug 1988).

A time-resolved magnetic spectrograph employing a gold Rutherford-scattering foil has been constructed to measure the parameters of the intense ion beams generated by Sandia National Laboratories' PBFA-II accelerator. The spectrograph operates by allowing the direct intense beam of PBFA-II to scatter from a thin gold foil to reduce its intensity for magnetic analysis. Details of the spectrograph's construction, detector package, and recent PBFA-II proton data are included in the paper.

50174 Multiframe ion pinhole camera for intense ion beam transport and focusing experiments. Stygar, W.A.; Leeper, R.J.; Mix, L.P.; Brock, E.R.; Bailey, J.E.; Hebron, D.E.; Johnson, D.J.; Lockner, T.R.; Maenchen, J.; Mehlhorn, T.A.; and others. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **59**: No. 8, 1703-1705(Aug 1988).

We have developed a new ion pinhole camera to obtain energy density profiles of a focused multiterawatt ion beam as a function of ion energy. Beam ions that are elastically scattered from a thin gold foil are imaged through six baffled pinholes onto six separate areas of a sheet of CR-39 nuclear track detector. Each of the areas is covered by an aluminum range filter and records an image with a different lower bound on the ion energy. Subtracting images with adjacent cutoff energies results in images with upper and lower bounds on the ion energy. Ion images are read from the CR-39 with VERA, a fully automatic, image-processor-based nuclear track counting system. Images of the Particle Beam Fusion Accelerator-II (PBFA-II) proton beam have been obtained and show that the beam has been focused to achieve a horizontal FWHM of 5.7 mm and has delivered 9 kJ/cm^2 to a target.

50175 Intense ion beam K/sub α/ measurements on PBFA-II. Maenchen, J.; Mehlhorn, T.A.; Wenger, D.F.; Leeper, R.J.; Johnson, D.J.; Lockner, T.R. (Sandia National Laboratories, P.O. Box 5800, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **59**: No. 8, 1706-1708(Aug 1988).

Inertial confinement fusion research efforts at Sandia National Laboratories center on generating and focusing high-intensity light ion beams on the Particle Beam Fusion Accelerator PBFA-II. A time-integrating three-frame ion beam spatial monitor was developed for these experiments to determine proton and lithium ion beam uniformity and orbit characteristics by imaging the ion-induced K/sub α/ line radiation. The three views of the ion beam are made off axis in three diode quadrants at a 3.8-cm radius. This spatial monitor, in conjunction with other beam diagnostics, allows experimenters to determine the high-voltage focusing characteristics of the ion diode.

50176 Simulation and interpretation of ion beam diagnostics on PBFA-II. Mehlhorn, T.A.; Nelson, W.E.; Maenchen, J.E.; Stygar, W.A.; Ruiz, C.L.; Lockner, T.R.; Johnson, D.J. (Sandia National Laboratories, P.O. Box 5800, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **59**: No. 8, 1709-1711(Aug 1988).

Ion diode and beam focusing experiments are in progress on PBFA-II working toward an ultimate goal of significant burn of an ICF pellet. Beam diagnostics on these experiments include a Thomson parabola, Kα x-ray pinhole cameras, filtered ion pinhole cameras, and a magnetic spectrometer. We are developing two new computer programs to simulate and interpret the data obtained from these diagnostics. VId-smcapsA is a VAX-based program that manipulates and unfolds data from digitized particle and x-ray diagnostic images. VId-smcapsA operations include: image display, background subtraction, relative-to-absolute coordinate transformations, and image projection into the beam reference frame. p-smcapsIc-smcapsd-smcapsIAg-smcaps allows us to study the effects of time-dependent ion focusing on the performance of ion beam diagnostics.

50177 Spatial distribution of fusion reactions by gamma-ray tomography. Moses, K.G.; Sperling, J.L.; Glassman, A.J.; Trow, J.R. (JAYCOR, Plasma Technology Division, Torrance, California 90503). *Review of Scientific Instruments;* **59**: No. 8, 1712-1714(Aug 1988).

This article reports on the application of the minor branch of the D—T reaction, $D^2 + T^3 = He^5 + \gamma(16.7\ MeV)$, as a diagnostic vehicle to determine the cross-sectional distribution of fusion reactions in a D—T burning plasma. Arrays of scintillation detectors, located circumferentially about the plasma, outside the reaction chamber, obtain line-integrated values of gamma-ray production along chords through the chamber. Tomographic techniques will be used to reconstruct the reacting profiles. A description of the tomographic system and reconstruction examples are presented.

50178 Calibration of the TFTR neutron activation system. Nieschmidt, E.B.; Saito, T.; Barnes, C.W.; Bosch, H.; Murphy, T.J. (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08544). *Review of Scientific Instruments;* **59**: No. 8, 1715-1717(Aug 1988).

Neutron generators, both D—D and D—T, have been used to calibrate the TFTR neutron activation (NA) system for point sources located within the tokamak. The foils used were In for D—D neutrons and Cu, Al, and ^{238}U for D—T neutrons. Delayed neutrons following fission were counted when using ^{238}U foils, 336-keV γ rays from $^{116}In(n,n')$/sup 115//sup m/ In reactions, annihilation radiation from ^{62}Cu following the $^{63}Cu(n,2n)^{62}Cu$ reaction, and 1368- and 2754-keV γ rays from the $^{27}Al(n,\alpha)^{24}Na$ reaction. Large effects caused by source anisotropy and local machine structure were observed. These effects and the attempts to accommodate them in the data analysis will be described.

50179 Calibration of a surface barrier detector for 14-MeV neutron flux measurements on TFTR. Bosch, H.; Strachan, J.D.; Barnes, C.W.; Nieschmidt, E.B. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 8, 1718-1720(Aug 1988).

Nuclear reactions in silicon semiconductor detectors with an energy threshold above 2.5 MeV can be used to measure dt neutrons in a high background of low-energy dd neutrons. This allows the measurement of 14-MeV neutrons from the d(t, n)α reaction in deuterium plasmas, where the tritons from the d(d, t)p reaction create 14-MeV neutrons due to burnup. Measurements with a surface barrier detector are presented together with the calibration of such a detector to measure the absolute 14-MeV neutron source strength.

50180 γ-ray diagnostic for the CIT. Petrasso, R.D.; Fiore, C.L.; Li, C. (Plasma Fusion Center, MIT, Cambridge, Massachusetts 02139). *Review of Scientific Instruments;* **59**: No. 8, 1721-1722(Aug 1988).

We have examined the feasibility of a fusion γ-ray diagnostic for the Compact Ignition Tokamak (CIT), which is expected to produce 10^{20} (d, t) fusion reactions per second. Gamma rays at 16.7 MeV are produced by the t(d, γ)He^5 fusion reaction. A Monte Carlo coupled neutron—photon transport code is used to model the expected γ-ray spectrum incident upon a Compton spectrometer backed by a Cerenkov detector. The results indicate that a signal of ~3 x 10^4 counts/s and a signal-to-noise ratio of ~30 can be achieved.

50181 Design and performance characteristics of the radiation shield developed for the TFTR charge exchange diagnostics. Roquemore, A.L.; Medley, S.S.; Scott, S.D. (Princeton University Plasma Physics Laboratory, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 8, 1726-1728(Aug 1988).

The high source strength of 2.45-MeV neutrons (~1.2 x 10/sup 16/ n/s) and neutron-induced gamma rays produced by the Tokamak Fusion Test Reactor (TFTR) have substantially degraded the performance of many diagnostics. In particular, data obtained by the charge exchange neutral analyzer (CENA) were seen to degrade at modest production levels of ~10/sup 15/ n/s. To reduce the radiation-induced noise to acceptable levels, massive shielding was required. A design and cost-effectiveness study was performed for the TFTR CENA which showed that a double-layered enclosure consisting of a 10-cm-thick inner housing of lead surrounded by a 23-cm-thick layer of 1.0% borated polyethylene was required to reduce the neutron and gamma noise level by two orders of magnitude. This design was recently implemented on TFTR and was shown to perform as predicted. The details of the enclosure will be presented and the contributing factors that led to the choice of this particular design will be reviewed.

50182 Neutral-beam diagnostic for fast confined alpha particles in a burning plasma: Application on CIT. Schlachter, A.S.; Stearns, J.W.; Cooper, W.S. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Review of Scientific Instruments;* **59**: No. 8, 1729-1731(Aug 1988).

Measurement of the slowing-down distribution for fast confined alpha particles is essential for a D—T burning-plasma experiment. Quantitative estimates of signal level for a fast neutral-beam probe using a two-electron-capture method of measuring the alpha-particle velocity distribution are presented as applied to the proposed tokamak CIT (Compact Ignition Tokamak). The best probe is found to be a fast ground-state helium-atom beam because of its relatively good penetration into a dense plasma and because of the large cross section for two-electron capture; fast He^0 can be produced in useful quantities from fast HeH^+, which is sufficient to allow time-resolved measurements of the alpha-particle velocity distribution in CIT.

50183 Neutron spectroscopy on TFTR. Strachan, J.D.; Nishitani, T.; Barnes, C.W. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Review of Scientific Instruments;* **59**: No. 8, 1732-1734(Aug 1988).

A ^3He ionization chamber was used to measure neutron spectra on TFTR during 1987. The ion temperature was deduced for one set of Ohmically heated plasmas and agreed within 20% with that measured by other diagnostics. The absolute efficiency was calibrated using a d—d neutron generator.

50184 Low-divergence, high-brightness lithium ion source for plasma diagnostics. Thomas, D.M.; West, W.P.; McCormick, K. (General Atomics, San Diego, California 92138). *Review of Scientific Instruments;* **59**: No. 8, 1735-1737(Aug 1988).

Plasma diagnostics employing energetic lithium beams are in routine use on several present-day tokamak experiments. These measurements are constrained by the availability of a suitable lithium ion source. Necessary and/or desirable parameters include narrow energy spread, high-emission current density, simplicity, and long lifetime. The existing ion gun on the TEXT experiment uses the thermionic emitter β-eucryptite and meets the above requirements, except for being limited to a useful emission of about 4 mA. We will present design criteria and accelerator results for a new ion gun capable of 15-mA emission based on an increased emitter area. Important design considerations are the thermal and

mechanical properties of the large (~20 cm^2) emitter area and the ion optics required to focus the emitted flux into a beam of ~1-cm^2 cross section. The potential improvement in the performance of both the TEXT and ASDEX diagnostic systems will be discussed.

50185 **Advanced plasma fluctuation analysis techniques and their impact on fusion research (invited).** Ritz, C.P.; Powers, E.J.; Rhodes, T.L.; Bengtson, R.D.; Gentle, K.W.; Lin, H.; Phillips, P.E.; Wootton, A.J.; Brower, D.L.; Luhmann N.C. Jr.; and others. (The University of Texas at Austin, Austin, Texas 78712). *Review of Scientific Instruments;* 59: No. 8, 1739-1744(Aug 1988).

This article reviews digital spectral analysis techniques that yield experimental insight into plasma turbulence. Methods to quantify the statistical properties of the fluctuations and to measure the particle and heat flux caused by electrostatic fluctuations are presented. Furthermore, analysis techniques to study the nonlinear coupling process of turbulence and the redistribution of energy among the different modes are discussed. The impact of the analysis techniques on fusion research is demonstrated with experimental results collected with Langmuir probes, heavy-ion beam probes, and laser scattering in the tokamak TEXT. Special emphasis is given to the characterization of the wavenumber distribution and the correlation lengths in all toroidal directions, including a first measurement of k/sub parallel/ in a tokamak.

50186 **Plasma diagnostics for the CIT (invited).** Medley, S.S.; Young, K.M.; CIT Diagnostics Team. (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08543). *Review of Scientific Instruments;* 59: No. 8, 1745-1750(Aug 1988).

The primary mission of the Compact Ignition Tokamak (CIT) is to study the physics of alpha-particle heating in an ignited D—T plasma. A burn time of about 10 tau/sub E/ is projected in a divertor configuration with base-line machine design parameters of R = 2.10 m, a = 0.65 m, b = 1.30 m, I/sub p/ = 11 MA, B/sub T/ = 10 T, and 10—20 MW of auxiliary rf heating. Plasma temperatures and density are expected to reach T/sub e/(0)~20 keV, T/sub i/(0)~30 keV, and n/sub e/(0)~1 x 10^{21} m^{-3}. The combined effects of restricted port access to the plasma, the presence of severe neutron and gamma radiation backgrounds, and the necessity for remote handling of in-cell components create challenging design problems for all of the conventional diagnostics associated with tokamak operations. In addition, new techniques must be developed to diagnose the evolution in space, time, and energy of the confined alpha distribution as well as potential plasma instabilities driven by collective alpha-particle effects. The design effort for CIT diagnostics is presently in the conceptual phase, with activity being focused on the selection of a viable diagnostic set and the identification of essential research and development projects to support this process. A review of these design issues and other aspects impacting the selection of diagnostic techniques for the CIT experiment will be presented.

50187 **Plasma fluctuation signal analysis tool.** Hong, J.Y.; Ritz, C.P.; Powers, E.J.; Kim, S.B. (Intelligent Signal Processing, Inc., 7719 Wood Hollow Drive, Suite 219, Austin, Texas 78731). *Review of Scientific Instruments;* 59: No. 8, 1751-1753(Aug 1988).

A plasma fluctuation signal analysis software package is described that surmounts common difficulties by using an information-hiding method and a layered structure.This approach leads to portability and easy customization for experimentalists who are not necessarily experts in signal analysis. The software contents and examples of applications to actual experimental data will be discussed.

50188 **Plasma fluctuation diagnostics via maximum entropy spectral estimation.** Levinson, S.J.; Kim, S.B.; Koh, T.; Powers, E.J. (The University of Texas at Austin, Austin, Texas 78712-1084). *Review of Scientific Instruments;* 59: No. 8, 1754-1756(Aug 1988).

The objective of this paper is to present a systematic comparison of the conventional fast Fourier transform and maximum entropy method (MEM) of spectral estimation of turbulent plasma fluctuation data. On the basis of this comparison, it appears that the MEM is the preferred approach for the spectral analysis of short time duration fluctuation records.

50189 **Spectral analysis of nonstationary plasma fluctuation data via digital complex demodulation.** Powers, E.J.; Don, H.S.; Hong, J.Y.; Kim, Y.C.; Hallock, G.A.; Hickok, R.L. (The University of Texas at Austin, Austin, Texas 78712). *Review of Scientific Instruments;* 59: No. 8, 1757-1759(Aug 1988).

Digital complex demodulation techniques are used to generate time-varying auto- and cross-power spectra which, in turn, are useful in characterizing the time-frequency characteristics of nonstationary plasma fluctuation data. The approach is illustrated with fluctuation data measured with a heavy-ion beam probe on the TMX experiment.

50190 **Plasma profile fitting and alternate-view generation.** Diesso, M.; Hill, K.; von Goeler, S. (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08544). *Review of Scientific Instruments;* 59: No. 8, 1760-1761(Aug 1988).

We present a method of using a plasma model to fit a given profile and using the model's parameters to generate the profile seen along any alternate chord. We illustrate the method with a simple "linearly shifted circle" model in which it is assumed that the plasma cross sections are circles that are shifted along the major radius of the vacuum vessel as a linear function of their radii. Sample test results are provided.

50191 **Image analysis and data-acquisition techniques for infrared and CCD cameras for ATF.** Young, K.G.; Hillis, D.L. (Oak Ridge National Laboratory, P.O. Box Y, Oak Ridge, Tennessee 37831). *Review of Scientific Instruments;* 59: No. 8, 1762-1764(Aug 1988).

A multipurpose image processing system has been developed for the Advanced Toroidal Facility (ATF) stellarator experiment. This system makes it possible to investigate the complicated topology inherent in stellarator plasmas with conventional video technology. Infrared (IR) and charge-coupled device (CCD) cameras, operated at the standard video framing rate, are used on ATF to measure heat flux patterns to the vacuum vessel wall and visible-light emission from the ionized plasma. These video cameras are coupled with fast acquisition and display systems, developed for a MicroVAX-II, which allow between-shot observation of the dynamic temperature and spatial extent of the plasma generated by ATF. The IR camera system provides acquisition of one frame of 60 x 80 eight-bit pixels every 16.7 ms via storage in a CAMAC module. The CCD data acquisition proceeds automatically, storing the video frames until its 12-bit, 1-Mbyte CAMAC memory is filled. After analysis, transformation, and compression, selected portions of the data are stored on disk. Interactive display of experimental data and theoretical calculations are performed with software written in Interactive Data Language.

50192 **ATF data system.** Wing, W.R.; Baylor, L.R.; Bell, J.D.; Burris, R.D.; DeVan, W.R.; Greenwood, D.E.; Kannan, K.L.; Ketterer, H.E.; Mankin, J.B.; Overbey, D.R.; and others. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Review of Scientific Instruments;* 59: No. 8, 1765-1767(Aug 1988).

The data system for the advanced toroidal facility (ATF) is a logical extension of the system used for the Impurity Studies Experiment ISX-B. Based on the ISX-B concepts and hardware, it extends them to provide support for long-pulse or steady-state operation of ATF. The system is now network based rather than shared memory based and can dynamically add or remove processors. The hardware consists of a pair of VAX 8700 CPUs and an assortment of MicroVAX front ends. This hardware acquires all data, generates all control waveforms, and provides trending and logging services for the safety interlock and control systems. These systems are based on programmable logic controllers (PLCs) which are independent of the data system. The software consists of three major components: a master scheduling and monitoring system (SAMS) that provides synchronizing services and allocates files and memory; a signal-based data and file management package (DMG) that provides data access services; and the ORNL CAMAC driver package. All diagnostics are supported by data acquisition and analysis software (either generic or specialized) that is based on and shared by these services.

50193 MINGL database system for TFTR. Wieland, R.M.; Murphy, J.A.; Goldston, R.J.; Zarnstorff, M.C. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 8, 1768-1770(Aug 1988).

The MINGL database system is an integrated set of tools which provides a means of collecting and managing diagnostic data and transport code results from TFTR. An interactive menu-driven format allows users to collect scalar and profile data from various data sources into shareable INGRES databases. LOCUS and INGRES/QUEL/SQL interfaces make it easy to browse, select, compare, and display the data in one of several formats. Utilities exist for managing the individual data sets and restricting their accessibility, for indexing the tables by author, and for maintaining a table of contents for an entire database. The modularity of the system allows automated database-server applications for between-shot analysis and display.

50194 Conceptual design of the physics support portion of the CIT instrumentation and control system. Sauthoff, N.R.; Stark, W.; Rauch, W.; Randerson, L.; Fleming, G. (Princeton Plasma Physics Laboratory, Princeton University, P.O. Box 451, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 8, 1771-1773(Aug 1988).

The conceptual design of the data handling system for the Compact Ignition Tokamak (CIT) takes advantage of the recent and upcoming advances in the technologies of database management systems, workstations, networking, and front-end processing. The software configuration of a diagnostic's front-end signal conditioning, data acquisition, and data reduction by means of filling in tables and specifying "objects" for the data transformations will provide a more powerful tool for efficient application "programming." The maintenance of an audit trail of chains of transformations (input data and processes) will permit identification and recalculation of results which are affected by modifications of calibrations and processing.

50195 Transparent data access in a multivendor, distributed data-acquisition and data processing system. Preckshot, G.G.; Butner, D.N.; Brown, M.D.; Meyer, W.H. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Review of Scientific Instruments;* **59**: No. 8, 1774-1776(Aug 1988).

Location-independent data access methods are being developed at Lawrence Livermore National Laboratory to manage and use data acquired by a multivendor distributed laboratory computer network. An interprocess communication system (IPCS) is used to connect tasks which produce, manage, or use experimental data. These tasks may run on any of the computers in the network. A central database and database server maintain supervisory records of experimental activity and locations of data produced by the experiment. Data may be located in several subsidiary local databases, file systems, or tape archives. Data access requests, if they cannot be satisfied locally, are routed via the IPCS to database servers, which locate and retrieve (or store) the requested data. We describe the design details and give examples of the current implementation.

50196 High-speed gated x-ray imagers (invited). Kilkenny, J.D.; Bell, P.; Hanks, R.; Power, G.; Turner, R.E.; Wiedwald, J. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Review of Scientific Instruments;* **59**: No. 8, 1793-1796(Aug 1988).

Single- and multiframe gated x-ray images with time resolution as fast as 150 ps are described. These systems are based on the gating of microchannel plates in a stripline configuration. The gating voltage comes from the avalanche breakdown of a reverse biased p—n junction producing high-power voltage pulses as short as 70 ps. Results from single- and four-frame x-ray cameras used on Nova are described.

50197 Determination of the structure of magnetic islands on TFTR (invited). Fredrickson, E.D.; McGuire, K.; Cavallo, A.; Grek, B.; Hattori, K.; Johnson, D.; Morris, A.W. (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08544). *Review of Scientific Instruments;* **59**: No. 8, 1797-1800(Aug 1988).

The Mirnov coil array, the horizontal soft x-ray camera, and the ECE (electron cyclotron emission) grating polychromator are used to unfold the structure of $m \geqq 2$ coherent magnetic fluctuations (assumed to be tearing modes) observed in TFTR. The modes are found predominantly in the enhanced confinement, or supershot, regime, and when present seriously degrade confinement. The poloidal and toroidal mode numbers (m and n) are determined with the Mirnov coil array. The radial structure is found by calculating the theoretical radial eigenmode (based on the calculated current-density profile) and scaling the resulting linear eigenmode with the measured fluctuation amplitude at the plasma edge. The presence of rotating magnetic islands is detected as fluctuations on both the chord-averaged soft-x-ray emissivity measurements and the fast grating polychromator electron temperature measurements. The ECE and soft-x-ray systems are used to identify coherent modes as islands and confirm estimates of the islands' location inferred from the Mirnov coil data and calculated current-density profiles.

50198 Time-resolved x-ray conversion efficiencies of laser-heated plasmas. Ze, F.; Kauffman, R.L.; Lasinski, B.; Suter, L.; Langer, S.; Kornblum, H.; Tietbohl, G.; Thiessen, T.; Montgomery, D.; Drake, R.P.; and others. (Lawrence Livermore National Laboratory, University of California, P.O. Box 5508, Livermore, California 94550). *Review of Scientific Instruments;* **59**: No. 8, 1801-1803(Aug 1988).

Experiments to obtain time-resolved, soft-x-ray emission from laser-driven plasmas are succinctly described. The spectra ($0.19\ \text{keV} \leqq h\nu \leqq 1.3\ \text{keV}$) at various times have been deconvolved and energy integrated to obtain time-resolved yields from Au disk targets. The temporal profiles of the total thermal x-ray output power follow the overall laser temporal shape but do not show the high-frequency fluctuation observed in the laser pulse. The behavior of the ratio of the instantaneous x-ray yields over the laser absorption is studied. The studies were done at the LLNL Nova laser facility. Single pulses and pulses in "picket fence" configuration were used to heat the gold targets.

50199 Photoconducting x-ray detectors for Z-pinch experiments. Spielman, R.B.; Hsing, W.W.; Hanson, D.L. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **59**: No. 8, 1804-1806(Aug 1988).

We have used GaAs and GaAs:Cr photoconducting detectors (PCDs) to measure the absolute x-ray output from 1 to 10 keV from Z-pinch plasma radiation sources. We calibrated the detectors over the spectral range of 900—3000 eV and found the spectral response to be constant to within the accuracy of the measurements. The flat spectral response, increased sensitivity (compared with bolometers), and good time response of the PCDs, coupled with their reliability and long lifetimes, have allowed us to acquire absolute x-ray data of significantly higher quality than possible with resistive bolometers or x-ray diodes (XRDs). An added attraction of PCDs is their smooth saturation at high incident x-ray fluxes. Unlike other types of electrical x-ray detectors, this feature allows a PCD to operate over a wide range of incident x-ray powers ($10—10^4\ \text{W/cm}^2$). We present results from gas puff Z-pinch experiments on Proto-II and Supermite comparing PCD, XRD, and resistive bolometer performance.

50200 Profile correction to electron temperature and enhancement factor in soft-x-ray pulse-height-analysis measurements in tokamaks. Sesnic, S.; Diesso, M.; Hill, K.; Holland, A.; Pohl, F. (Princeton University, Plasma Physics Laboratory, P.O. Box 451, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 8, 1810-1812(Aug 1988).

Because soft-x-ray pulse-height-analysis spectra contain chordal information, the electron temperature and the radiation intensity (enhancement factor) measurements do not represent the local values. The correction factors for the electron temperature

and the enhancement factor as a function of the temperature and density profile parameters and the energy are obtained. The spectrum distortion due to pulse pileup effects is also evaluated. A set of curves is given from which the distortion of the spectrum can be obtained if the electron temperature, the Be filter thickness, and the electronic parameters of the acquisition system are known. PG 1810,1812 ID 131801CON N X-ray diagnostics TT Profile correction to electron temperature and enhancement factor in soft-x-ray pulse-height-analysis measurements in tokamaks AU S. Sesnic, M. Diesso, K. Hill, and A. Holland LO Princeton University, Plasma Physics Laboratory, P.O. Box 451, Princeton, New Jersey 08543 AU F. Pohl LO Max-Planck Institut fuer Plasmaphysik, 8046-Garching, Federal Republic of Germany SD (Presented on 16 March 1988) AB Because soft-x-ray pulse-height-analysis spectra contain chordal information, the electron temperature and the radiation intensity (enhancement factor) measurements do not represent the local values. The correction factors for the electron temperature and the enhancement factor as a function of the temperature and density profile parameters and the energy are obtained. The spectrum distortion due to pulse pileup effects is also evaluated. A set of curves is given from which the distortion of the spectrum can be obtained if the electron tempe

50201 **Soft-x-ray Bragg spectrograph with an intensified framing camera.** Koenig, Z.M. (KMS Fusion, Ann Arbor, Michigan 48106). *Review of Scientific Instruments;* **59**: No. 8, 1813-1815(Aug 1988).

A Bragg x-ray spectrograph was developed for pulsed diagnostics. It covers the wavelength region 2—100 A and accommodates two convex crystals and a time-resolving x-ray intensifier. The x-ray detector is a gated intensified camera incorporating a custom-designed microchannel plate (MCP) built into a microwave circuit for fast pulsing of four or seven separate images. Various photocathodes (Au, Ni, CsI, and MgF_2) have been deposited directly onto the microchannel plate to form the strip lines. The MCP is mounted above a high-quality phosphor screen coated on top of a fiber-optic faceplate. Time resolution is obtained by sequentially gating the independent strip electrodes on the MCP for subnanosecond electrical gating. A one-dimensional time-resolved spectral image can be obtained.

50202 **Tomographic imaging of MHD activity in tokamaks by combining diode arrays and a tangentially viewing pinhole camera.** Holland, A.; Fonck, R.J.; Powell, E.T.; Sesnic, S. (Plasma Physics Laboratory, Princeton University, P.O. Box 451, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 8, 1819-1821(Aug 1988).

Two 32-channel side-viewing soft x-ray diode arrays will be installed on PBX-M which will provide profile information in the horizontal and vertical directions with a time resolution up to 1 μs. The information from these arrays can be reconstructed to provide a high time-resolution poloidal emission profile using a maximum-entropy-based technique which incorporates the reconstructed profile from a tangentially viewing soft x-ray pinhole camera. The pinhole camera provides lower time-resolution (about 5 ms) shape information which has been reconstructed with the assumption of toroidal symmetry. The pinhole camera information supplements the information from the diode arrays, allowing a reconstruction which can resolve MHD fluctuations of the equilibrium profile. The pinhole camera information need only be a better approximation to the real emission profile than the assumption of a flat profile since the algorithm uses it as a first-order solution which is perturbed by the information from the diode arrays. The algorithm can also explicitly include the bean-shaped PBX-M vacuum vessel and the vignetting of some detectors by the pusher coil.

50203 **Time-resolved doubly bent crystal x-ray spectrometer.** Hockaday, M.P.; Wilke, M.D.; Blake, R.L.; Vaninetti, J.; Gray, N.T.; Nedrow, P.T. (Physics Division, Los Alamos National Laboratory, P. O. Box 1663, MS D410, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* **59**: No. 8, 1822-1824(Aug 1988).

X-ray spectroscopy is an essential tool in high-temperature plasma research. We describe a time-resolved x-ray spectrometer suitable for measuring spectra in harsh environments common to many very high-energy density laboratory plasma sources. The spectrometer consisted of a doubly curved Si(111) crystal diffraction element, a WL-1201 (ZnO:Ga) phosphor, a coherent fiber-optic array, and two visible streak cameras. The spectrometer design described here has a minimum time resolution of 1.3 ns with 2.8-eV spectral resolution over a 200-eV-wide bandpass in the 6—7-keV region of the spectrum. Complete system spectral throughput calibrations were done at the Cornell High Energy Synchrotron (CHESS). Details of the design and calibration results are presented.

50204 **Excitation rates for plasma impurity measurements by x-ray diagnostics.** Hill, K.W.; Bitter, M.; von Goeler, S.; Hsuan, H.; Hulse, R.; Johnson, L.C.; Lasalle, P.; McGuire, K.S.; Murphy, A.; Stevens, J.E.; and others. (Princeton University Plasma Physics Laboratory, Princeton, New Jersey 08544). *Review of Scientific Instruments;* **59**: No. 8, 1825-1827(Aug 1988).

Measurement of intrinsic and injected impurity concentrations and transport in tokamak plasmas by x-ray pulse-height analysis (PHA) and x-ray imaging (XI) diode arrays requires reliable excitation rates for a number of charge states of a range of elements (Al, Se, Ti, Cr, Fe, Ni, Ge, etc.). Previous PHA measurements at Princeton have relied on a coronal-equilibrium average of excitation rates for iron, and a prescription for scaling the average rate to nearby elements. For improved accuracy in PHA measurements (using the MIST impurity equilibrium and transport code) and for interpretation of XI data (using an x-ray simulation code), rates for excitation of dominant charge states by electron impact, dielectronic recombination, and radiative recombination have been calculated from available atomic data and parametrized as a function of atomic number ($Z = 10—42$) and electron temperature (T/sub e/ = 0.1—10.0 keV).

50205 **Elliptical spectrograph/gated microchannel-plate detector for time-resolved spectral measurements in the x-ray region.** Hammel, B.A.; Ruggles, L.E. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **59**: No. 8, 1828-1830(Aug 1988).

Time-resolved measurements from an elliptical crystal spectrograph are used to diagnose x-ray laser experiments on a gas puff Z pinch. The elliptical spectrograph (1.2-m working distance, eccentricity 0.9586) observes the 1-keV region, covering a range of $\lambda/2d = 0.5$ to 0.9. A thin filter (0.2 μm Al on 2 μm Kimfol) stretched across the spectrograph exit slit acts as a low-energy x-ray cutoff and as a vacuum window, allowing the detector to be at high vacuum regardless of the pressure in the experimental chamber. The detector consists of a seven-frame microchannel-plate intensifier system. A pulser is used to gate each of seven striplines on the microchannel plate, providing nanosecond resolution. With this instrument we are able to measure the pump radiation from the imploding plasma (Ne or Ar) and converter layer (Al), and to study the lasant ionization state (Ne-like Ni or Cu).

50206 **Soft-x-ray camera for internal shape and current-density measurements on a noncircular tokamak.** Fonck, R.J.; Jaehnig, K.P.; Powell, E.T.; Reusch, M.; Roney, P.; Simon, M.P. (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 8, 1831-1833(Aug 1988).

A two-dimensional, tangentially viewing, soft-x-ray pinhole camera has been fabricated to provide internal shape measurements on the PBX-M tokamak. It consists of a scintillator at the focal plane of a foil-filtered pinhole camera, which is, in turn, fiber-optically coupled to an intensified framing video camera ($\Delta t \geq 3$ ms). Automated data acquisition is performed on a stand-alone image processing system, and data archiving and retrieval take place on an optical disk video recorder. The derivation of the poloidal emission distribution from the measured image is done by fitting to model profiles.

50207 **XRD array, grazing incidence spectrometer, and x-ray imaging camera on PBFA II.** Derzon, M.S.; Sweeney, M.A.; Grandon, P.; Ives, H.C.; Kensek, R.P.; Mix, L.P.; Stygar, W.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **59**: No. 8, 1834-1836(Aug 1988).

Target diagnostics on PBFA II will include a time-resolved x-ray diode array, an energy-resolved, time-integrated x-ray camera, and a grazing incidence spectrometer. A clean vacuum, independent of that on PBFA II, will be supplied to the detectors to maintain more reproducible calibrations. We also describe the diagnostics and outline the calculations which determined the shielding required. Based on the calculations the background due to bremsstrahlung in the least sensitive diagnostic is 12 eV/pixel. The appropriate shielding is being built to field these diagnostics.

50208 **UV to soft-x-ray surveys using a compact, biplanar diode array.** Armentrout, C.J.; Geddes, J.B.; Lee, P.; Canfield, L.R. (KMS Fusion, Inc., P.O. Box 1569, Ann Arbor, Michigan 48106-1569). *Review of Scientific Instruments;* **59**: No. 8, 1843-1845(Aug 1988).

Biplanar vacuum diodes, long used for the diagnostics of laser-produced plasmas, have also been used as spectroscopic survey instruments for magnetically confined plasmas. The compact seven-channel diode array, developed at KMS Fusion, provides broadband ($\Delta E/E \cong 1$) channels of filtered cathodes to provide the spectral scan from 10 eV to about 5 keV (approximately 130 to 0.25 nm). Preliminary calibration results and calculations for a number of filters and cathodes are used to demonstrate that a satisfactory energy region may be obtained if an absorption edge of the cathode is below the mean energy of the desired channel and an absorption edge of the filter is above that energy. These devices are insensitive to neutron and gamma flux.

50209 **X-ray response of AlGaAs/GaAs radiation-hardened double-heterostructure photodiode compared to Si:p-i-n photodiodes.** Anthes, J.P. (Sandia National Laboratories, P. O. Box 5800, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **59**: No. 8, 1846-1848(Aug 1988).

Requirements for continuous operation of photodiodes in the presence of nuclear radiation has led to the development of a novel AlGaAs/GaAs photodiode. Device structure and semiconductor properties of this design were optimized to balance the need for photodetection at $\lambda = 820$ nm against unwanted excess photocurrents induced by ionizing radiation. To achieve radiation hardness the photodiode employs a double-heterojunction device structure. The spectral response of this detector, 1 keV—10 MeV, may offer unique opportunities for use in high-temperature plasma diagnostics compared to typical bare Si:p-i-n x-ray photodiode characteristics. Application of this AlGaAs/GaAs detector in a fiber-optic link will be reviewed. Also, use of this detector in simple atomic-absorption-edge filtered x-ray detector channels is presented.

50210 **Characterization of a high-magnification x-ray microscope on Nova (abstract).** Glendinning, S.G.; Phillion, D.W.; Kilkenny, J.D. (Lawrence Livermore National Laboratory, P. O. Box 5508, Livermore, California 94550). *Review of Scientific Instruments;* **59**: No. 8, 1852-1852(Aug 1988).

We have implemented a Wolter-type x-ray optic in a high-(22 x) magnification microscope on Nova. We report on the online characterization of this system and show results from the several types of experiments performed. The point spread function, contrast transfer function at selected spatial frequencies, x-ray throughput, alignment accuracy, and field of view have all been measured as configured for Nova experiments. Such characterization may be used to remove the degradation introduced by the instrument. This work was performed under the auspices of the U.S. DOE by the Lawrence Livermore National Laboratory under Contract No. W-7405-ENG-48.

50211 **Measurements of the ion temperature and plasma rotation from Kα emission with the TFTR horizontal x-ray crystal spectrometer (abstract).** Hsuan, H.; Bitter, M.; Rice, J.E.; Hill, K.W.; Johnson, L.; Liew, S.L.; Scott, S.D.; von Goeler, S. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 8, 1853-1853(Aug 1988).

The TFTR horizontal x-ray crystal spectrometer has been improved by installation of γ and neutron shielding and is now operating in the TFTR Test Cell up to the presently maximum neutron production rates of 2×10^{16} neutrons/s. Further optimization by using a modified detector may assure operation of the spectrometer during the DT phase when TFTR is covered by an igloo. The instrument is set up for simultaneous observation of the entire satellite spectrum of Ni XXVII, and it provides data on the time evolution of the central ion temperature and the central plasma rotation velocity. Ion temperatures of 20—30 keV have been measured under "supershot" conditions. The highest rotation velocity observed with unidirectional injection was 1.1×10^6 m/s.

50212 **Time-resolving x-ray diagnostics for ICF (invited).** Jaanimagi, P.A.; Bradley, D.K.; Duff, J.; Gregory, G.G.; Richardson, M.C. (Laboratory for Laser Energetics, University of Rochester, 250 East River Road, Rochester, New York 14623-1299). *Review of Scientific Instruments;* **59**: No. 8, 1854-1859(Aug 1988).

X-ray streak cameras, which can be coupled to a large variety of spectroscopic or imaging devices, provide an important research tool for studying laser fusion plasmas. Generally, several of these instruments are deployed simultaneously on a given experiment to furnish a comprehensive data set of the x-ray emission spectrum and target hydrodynamics. Of particular importance is the ability to do quantitative analysis with the data set. This allows meaningful comparisons to be made with simulations. The sophistication of the hydrodynamic and atomic physics codes is such that qualitative analysis is insufficient. Various simple parameters in these codes are bench-marked against experimental measurements before more detailed calculations are performed. As in all diagnostic systems the range of linear response must be well defined. In this article we will discuss some of the constraints inherent in streak camera systems and how they affect the acquisition and analysis of the experimental results. Examples illustrating our current capabilities for diagnosing experiments on the OMEGA laser fusion facility will be presented.

50213 **Intense ion beam diagnostics for particle beam fusion experiments on PBFA II (invited).** Leeper, R.J.; Stygar, W.A.; Maenchen, J.; Ruiz, C.L.; Kensek, R.P.; Johnson, D.J.; Lockner, T.R.; Bailey, J.; Cooper, G.; Lee, J.R.; and others. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **59**: No. 8, 1860-1865(Aug 1988).

A review of the diagnostics used at Sandia National Laboratories to measure the parameters of intense proton and lithium beams generated on the PBFA-II accelerator will be presented. These diagnostics consist of several types, namely: Kα x-ray pinhole cameras, a multiframe dE/dx ion pinhole camera, a p-i-n array ion pinhole camera, Thomson parabola spectrographs, a Rutherford magnetic spectrograph, plasma visible spectroscopy, and several nuclear activation diagnostics. These components, when taken together, enable a rather thorough description of the 5-MV, 10-TW ion beams presently being produced. A unique feature of these diagnostics is that they are capable of operating in hard (several MeV) x-ray bremsstrahlung backgrounds of some 10^9—10^{10} rad/s. Details of each diagnostic, its integration, data reduction procedures, and recent PBFA-II data will be discussed.

50214 **Measurements using tangentially viewing bolometers on TFTR.** Bush, C.E.; Schivell, J.; Budny, R.; Ellis R.A. III; Goldston, R.J.; McCune, D.; Medley, S.S.; Scott, S.D.; Towner, H.H.; Wieland, R.M.; and others. (Princeton Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Review of Scientific Instruments;* **59**: No. 8, 1869-1871(Aug 1988).

Co- and counter-viewing bolometers aimed along a common tangency chord are being used to study power losses due to charge exchange (CX) of fast ions in neutral beam injection (NBI) heated TFTR plasmas. For unidirectional injection, tangential bolometers oriented to view CX loss of circulating fast ions detect losses from the thermal target plasma (impurity radiation and CX) plus power due to the fast ion CX loss, whereas bolometers oppositely directed measure only the target plasma contribution. The difference between the two signals is a measure of the fast ion CX loss. Additional information is obtained by comparing the tangential bolometer signals with those of perpendicularly viewing bolometer monitors and arrays. The measurements are compared to results of the TRANSP code analysis.

50215 **Bolometers for CIT.** Schivell, J. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543). *Review of Scientific Instruments;* 59: No. 8, 1872-1874(Aug 1988).

Designing bolometers for Compact Ignition Tokamak presents difficult, perhaps insurmountable, challenges. Detector environment will be quite harsh, viewing access will be severely limited, and, most importantly, the heating of detectors by neutron and gamma radiation will be larger than that by the radiation losses to be measured. Furthermore, the radiation losses themselves will no longer be dominated by impurity radiation as in earlier machines, but will be a combination of impurity radiation, bremsstrahlung, and synchrotron radiation. Possible approaches to a design have been developed, based on optimizing the response to VUV- and x-radiation, possible local shielding, subtraction of the n and γ heating, constant in situ calibration, and deployment of the detectors in a tangentially viewing array. The array makes it possible to cover the plasma cross section, as well as to see into the divertors. Estimates indicate that it should be possible to make successful measurements of the two-dimensional radiation loss profile.

50216 **Infrared thermography of the DIII-D divertor targets.** Hill, D.N.; Ellis, R.; Ferguson, W.; Perkins, D.E.; Petrie, T.; Baxi, C. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Review of Scientific Instruments;* 59: No. 8, 1878-1880(Aug 1988).

The power flow to the DIII-D divertor targets is routinely measured using infrared (IR) thermography. An IR television camera sensitive to radiation in the 8—12-μm range views the divertor region using a set of germanium optics. Digital signal processing is used to extract the desired surface temperature profiles from the analog data ($\simeq$12 Mbytes) stored on videotape. Inversion of these data using a simple matrix formulation of the inverse heat conduction problem then yields the incident heat flux as a function of space and time. Results from a DIII-D discharge are included.

50217 **Preparation of TFTR diagnostics for D—T breakeven experiments.** Johnson, L.C.; Manos, D.M.; Young, K.M. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey 08543). *Review of Scientific Instruments;* 59: No. 8, 1881-1883(Aug 1988).

Although diagnostic systems for the tokamak fusion test reactor (TFTR) must be compatible with high-power experiments in deuterium—tritium (D—T) plasmas, it has been neither possible nor desirable to implement all the required features during the early phases of the facility. The research plan, the physical plant, instrumentation, and diagnostic techniques have all evolved during the past decade, and some of the original plans are no longer suitable. Preparations are now underway for D—T operation in TFTR in 1990. Among the activities necessary in support of the research plan are completion of the installation of the D—T diagnostic set, modification of diagnostic hardware to accommodate the "igloo" radiation shield of the torus, installation of auxiliary shielding for detectors and electronics, and enhancement of the reliability of specific components. These preparations and the final D—T diagnostic set for TFTR will be described.

50218 **Hydrogen particle diagnostic based on Pd-MOS diode arrays.** Bastasz, R.; Hughes, R.C. (Sandia National Laboratories, Livermore, California 94550 and Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* 59: No. 8, 1884-1886(Aug 1988).

The reverse-bias current through a Pd-MOS diode changes when hydrogen is present at the diode interface and this effect provides the bias for a solid-state detector to monitor the flux and energy of hydrogen particles emanating from a beam or plasma. The addition of a coating atop the Pd forms a high-pass energy filter and an array of coated Pd-MOS diodes can function as a compact, hydrogen-specific, energy spectrometer. The response characteristics of an Au-coated Pd-MOS diode array have been measured using a low-energy hydrogen ion source. The array has several desirable characteristics for energetic hydrogen detection. Its response is dosimetric, it discriminates between hydrogen irradiations at different energies, and it can be regenerated by heating briefly to 100—200 °C. These properties make Pd-MOS diode arrays attractive candidates for remote plasma-edge flux and energy monitors in fusion devices.

50219 **Analysis of Langmuir probe measurements from the Tandem Mirror Experiment Upgrade (TMX-U).** Buchenauer, D.; Molvik, A.W. (Sandia National Laboratories, Livermore, California 94550). *Review of Scientific Instruments;* 59: No. 8, 1887-1889(Aug 1988).

A nonlinear least-squares curve-fitting routine has been used to analyze single-tip Langmuir probe measurements from the Tandem Mirror Experiment Upgrade during high-density ($\simeq$1 x 10^{13} cm^{-3}) operation. This procedure provided estimates of uncertainties (variances) in the electron temperature and plasma density due to noise in the probe current. The electron temperature and plasma potential inferred from the fit were found to increase with the upper cutoff voltage used above a certain voltage. This effect appears to be due to a departure of the electron current from an exponentially increasing function for probe positions inside the limiter radius only. The fitted values for electron temperature and plasma density are consistent with previous measurements obtained with a double-tipped probe and the fitted values of space potential indicate a linear relationship with electron temperature.

50220 **Artificial cooling due to quiet injection in bounded plasma particle simulations.** Lawson, W.S. (Electronics Research Laboratory, University of California, Berkeley, California 94720). *Journal of Computational Physics;* 77: No. 2, 330-339(Aug 1988).

An explanation is proposed for an artificial cooling effect seen in electrostatic particle-in-cell plasma simulations. The effect hinges on heat transport from the trapped electrons to fluctuations of the electric field, which are kept at a sub-thermal level through the continuous "quiet" injection of passing electrons. Further simulations are done which test and support the explanation. copyright 1988 Academic Press, Inc.

50221 **An exact solution to the relativistic equation of motion of a charged particle driven by a linearly polarized electromagnetic wave.** Shebalin, J.V. (National Aeronautics and Space Administration, Langley Research Center, Hampton, VA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* 37: No. 3, 390-392(Jun 1988).

An exact analytic solution is found for a basic electromagnetic wave-charged particle interaction by solving the nonlinear equations of motion. The particle position, velocity, and corresponding time are found to be explicit functions of the total phase of the wave. Particle position and velocity are thus implicit functions of time. Applications include describing the motion of a free electron driven by an intense laser beam.

50222 **Electrostatic ion-cyclotron waves in a two-ion component plasma.** Suszcynsky, D.M.; Merlino, R.L.; D'Angelo, N. (Dept. of Physics and Astronomy, Univ. of Iowa, Iowa City, IA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* 16: No. 3, 396-398(Jun 1988).

The excitation of electrostatic ion-cyclotron (EIC) waves is studied in a single-ended Q machine in a two-ion-component plasma (Cs/sup +/ and K/sup +/). Over a large range of relative concentrations of Cs/sup +/ and K/sup +/ ions, two modes are excited with frequencies ω/sub 1/ $\geq$ Ω/sub Cs/sup +// and ω/sub 2/ $\geq$

Ω/sub K/sup +//, where the Ω's are the respective cyclotron frequencies. The results are discussed in terms of a fluid theory of electrostatic ion cyclotron waves in a two-ion component plasma.

50223 **Line broadening of hydrogenic ions in dense plasmas.** Stamm, R.; Talin, B.; Pollock, E.L.; Iglesias, C.A. pp 141-159 of Spectral line shapes. Volume 4 - Proceedings of the Eighth International Conference, College of William and Mary, Williamsburg, VA, June 9-13, 1986. Exton, R.J. Hampton, VA; A. Deepak Publishing (1987). (CONF-8606230—).

From 8. international conference on spectral line shapes; Williamsburg, VA, USA (9 Jun 1986).

A computer code for deriving the line shape of hydrogenic ions in a hot, dense plasma is presently used to investigate a wide range of plasma conditions, using either a standard molecular-dynamics simulation or an independent perturber model for the ions. The primary advantage of the model lies in its retention of the effect of ion dynamics on line shape. The coupling between the Stark and Doppler effects is also analyzed by means of molecular dynamics; during the time interval of interest for line broadening, the emitters are free-streaming, and there is no collisional narrowing. 28 references.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 48732, 48733, 48981, 49068, 49251, 49294, 50077, 50115, 50121, 50138, 50171, 50172, 50175, 50181, 50184, 50196, 50198, 50210, 50212, 50221

50224 **(AD-A—194118/6/XAB) Modeling of atomic processes in x-ray laser plasmas. Final report, 19 September 1986-19 September 1987.** (Berkeley Research Associates, Inc., CA (USA)). Mar 1988. 27p. (BRA—88-W030R). NTIS, PC A03/MF A01.

It is demonstrated that the linear response scheme within the framework of density functional method can provide reliable atomic data for various atoms and ions of experimental interest. This model is particularly useful in those situations where conventional independent particle models fail to generate accurate data. The atomic structure code for multielectron ions of arbitrary Z is of central importance in these calculations. Proper relativistic treatment is included for high-Z ions. The mechanism of time-dependent polarization of the atom is seen to be important in describing the experimental observations. For most experimental situations, the present method is adequate and very useful. If the applied radiation field strength is very high, suitable generalization of the present model or developement of new techniques are necessary to treat those conditions.

50225 **(CONF-871007—101) Fabrication of the helical field coil components for the advanced toroidal facility.** Cole, M.J.; Whitson, J.C.; Banks, B.J. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (USA); CBI Services, Inc., Birmingham, AL (USA)). 1987. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015228/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

The fabrication techniques used to manufacture the major components of the helical field (HF) coil segments for the Advanced Toroidal Facility (ATF) are described. The major components of an HF coil segment are 14 water-cooled, copper conductors and a T-shaped stainless steel support member (or "tee"). Twenty-four of these segments were used in the fabrication of two coils for the ATF experiment. The helical shape, accurate position requirements, large size, and potential for high cost required unique approaches to the fabrication of these components. One method of fabrication was to use 44-mm-thick (standard size) plate to form the base and leg of the tee and to join the sections by welding. Because of the tolerance requirements, a thicker plate (70 mm) was used and then contour machined to the final shape. The second approach, conducted in parallel with the first, was to cast the tee as a single piece. The first attempts were to make the casting larger than required, then machine it to final size and shape. The cost of machining either the welded tee or the cast tee was extremely high, so several prototypes were fabricated until a cast tee that required no contour machining was produced. The shape and positional requirements were also the major problems in fabricating the copper conductors, or turns. The approach taken was to make an accurate fixture and position the turns in the fixture, then anneal to remove residual stresses and form the copper turns to the shape of the fixture. The lessons learned in pursuing these fabrication methods are presented. 5 refs., 3 figs.

50226 **(CONF-871007—102) Comparative analysis of next-generation INTOR-like designs.** Flanagan, C.A.; Galambos, J.D.; Peng, Y.K.M. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 4p. Q/MF A01; 1; GPO Dep. Order Number DE88015227/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

An analytic comparison of five INTOR-like designs has been completed as part of the INTOR Workshop effort. The five designs include INTOR, NET, FER, TIBER, and OTR. The purpose of the study was to provide a quantitative information base to determine the specific impact of how different choices affect a design. Calculations were performed to demonstrate the ability to benchmark the designs, to examine sensitivities to various design choices, and to examine relative capital costs. 6 refs., 3 figs., 4 tabs.

50227 **(CONF-880793—1) Poloidal VV currents, disruption-induced VV forces, and TSC-EIGENCIRC interfaces.** Sayer, R.O. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 16p. NTIS, PC A03. Order Number DE88015299/JAW.

From CIT PF workshop; Princeton, NJ, USA (12 Jul 1988).

This paper discusses the following topics: Poloidal vacuum vessel currents induced by toroidal flux changes; TSC disruption-induced forces on the CIT 2.10m vacuum vessel; status of EIGEN-CIRC-TSC interface; and TSC disruption run with external TF structure. 6 figs., 2 tabs. (LSP)

50228 **(CONF-8806170—4) The reactivity of the residual blowing gases in glass shells.** Ebner, M.A.; Miller, W.J.; Thompson, L.T. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1988. Contract AC03-87DP10560. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE88013012/JAW.

From 6. target fabrication specialist's meeting; Los Alamos, NM, USA (19 Jun 1988).

Results of this work indicate that the residual Co_2, in glass ICF targets can be hydrogenated to lower-Z species during the permeation filling of the glass shells. Deuterium species CO_2, to CO, while DT or T_2 reduce CO_2 to a mixture of CO and hydrocarbons. Water, a major byproduct of these reactions, is lost by out permeation. Evidently, β radiation facilitates the complete hydrogenation of CO_2. Future work will determine the catalytic activity of the conventional ICF glass shell surfaces, and shell surfaces of glasses that have been doped with transition metals. In addition, we plan to determine the kinetics of these reactions and the effects of β (from both tritium and external sources), gamma, and possibly rf radiation on the reaction rates and product distributions.

50229 **(CONF-8806201—1) Remote maintenance systems requirements are being developed to provide design guidelines for machine components, to define maintenance interfaces, and to quantify maintenance equipment and procedures needed.** Spampinato, P.T.; Tabor, M.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015315/JAW.

From Engineering Review Board meeting for the compact ignition tokamak; Princeton, NJ, USA (21 Jun 1988).

50230 **(DOE/ER/53192—T3) Plasma exposure tests of a carbon fiber/epoxy composite.** Schneider, T.; Rome, J. (Auburn Univ., AL (USA)). Jul 1988. Contract FG05-85ER53192;AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014724/JAW.

An experiment was conducted to test the exposure of a vacuum chamber made of a carbon fiber/epoxy composite to a plasma environment. In previous tests this material(CE 339, made by Ferro Corp.) has shown good vacuum properties and has also demonstrated the capability to withstand high energy electron beams in tests at the Naval Research Laboratory. Based on these promising results, the Torsatron Group at Auburn University conducted plasma exposure tests on a section of carbon fiber/epoxy composite pipe furnished by Oak Ridge National Laboratory. 1 ref, 2 figs.

50231 **(EGG-FSP—8050) Pyrophoricity of tritium-storage bed materials.** Longhurst, G. R. (EG and G Idaho, Inc., Idaho Falls (USA)). Mar 1988. Contract AC07-76ID01570. 22p. (CONF-880505—40). NTIS, PC A03/MF A01; GPO Dep. Order Number DE88015105/JAW.

From 3. topical meeting on tritium technology in fission, fusion and isotopic applications; Toronto, Canada (1 May 1988).

Experiments were conducted on samples of depleted uranium and on intermetallic compounds of zirconium--cobalt and lanthanum--nickel--aluminide to evaluate the pyrophoricity of the activated materials and their hydrides and deuterides on exposure to air. It was found that none of the materials spontaneously ignited when exposed to room temperature air, but the uranium and the zirconium--cobalt both ignited in air at moderately elevated temperatures. Activated (dehydrided) materials showed stronger reactions than did the hydrides, but they ignited at essentially the same temperatures. Deuterides showed effectively the same characteristics as the hydrides except the ignition temperature of zirconium--cobalt deuteride was reduced by 20--50 K from that of the hydride. The possibility of a fire in tritium storage beds is real, especially if uranium or zirconium--cobalt are used as storage materials, but fires may not occur until the bed is heated. 9 refs., 12 figs., 1 tab.

50232 **(KMSF-U—1972) Recent results in glass shell fabrication.** Miller, W.J.; Belanger, R.P. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1988. Contract AC03-87DP10560. 11p. (CONF-8806170—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013020/JAW.

From 6. target fabrication specialist's meeting; Los Alamos, NM, USA (19 Jun 1988).

As the ICF program advances, the energy delivered by drivers increases, requiring glass shell targets of larger diameters and wall thicknesses. Our glass shell fabrication goals then are to steadily increase the range of diameters and wall thicknesses we can make as well to increase the average wall uniformity over the entire size range. Using our drop tower technology we are pursuing two approaches: to optimize the key experimental processing parameters, and to optimize the feed-stock gel composition. In the early 80's we emphasized the processing parameters, achieving greater control and reliability over the process as well as extending the shell size range. More recently we have concentrated on the gel feed-stock. In this paper we report significant increases in the shell size range and overall wall uniformity of our shells using optimal gel feed-stock. In addition we report on-going experiments (similar to those used in industry for quality assurance) designed to identify any significant processing parameters not found by our other methods. 5 refs., 5 figs.

50233 **(KMSF-U—1975) The tensile strength of glass shells.** Ebner, M.A.; Miller, W.J.; Evans, J.L. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1988. Contract AC03-87DP10560. 12p. (CONF-8806170—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013011/JAW.

From 6. target fabrication specialist's meeting; Los Alamos, NM, USA (19 Jun 1988).

Glass shells used as ICF fuel containers must withstand extreme external and internal pressure. A shell's resistance to external pressure (compressive strength) determines how rapidly it can be filled with fuel by permation; its resistance to internal pressure (tensile strength) determines how much gaseous fuel it can ultimately hold. Tensile strength is difficult to study because it is a function of the history of the glass and does not have an inherent value. While the theoretical strength of glass is on the order of 1.38 to 3.44 x 10^{10} Pa, the actual strength of a particular glass object is usually several orders of magnitude lower, and is determined by the flaw population. Furthermore, tensile failure can occur either by stress intensification at the tips of surface flaws and defects, or by crack growth induced by stress corrosion (delayed failure or fatigue). Consequently, since flaws are generally produced on the surface of glass objects by handling and exposure to an abrasive or reactive environment, glass fracture is highly random in nature. These considerations have caused increasing concern in target fabrication as target sizes have increased and specifications become more stringent. We seek to determine the effects on tensile strength of the permeant gas, and of the geometric characteristics, surface area, and glass volume of the shells. As the failures have become more costly, greater target reliability (or predictability) has become increasingly desirable. We have therefore resumed studies to determine the effective tensile strength of glass shells. 13 refs., 5 figs., 1 tab.

50234 **(KMSF-U—1993) Measurement of glass shell buckling strength using a piezoelectric film sensor.** Schneggenburger, R.G.; Loughrey, L.A.; Butkiewicz, D.A.; Bandy, K.A. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1988. Contract AC03-87DP10560. 7p. (CONF-8806170—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013016/JAW.

From 6. target fabrication specialist's meeting; Los Alamos, NM, USA (19 Jun 1988).

The importance of glass shell strength becomes clear when one attempts to fill 100 carefully characterized, thin wall glass shells with a high pressure of fuel gas. Unless care is exercized in controlling the driving pressure, many of the shells will break, wasting the time and effort of characterization and losing valuable shells. KMS Fusion has pursued shell strength studies for over ten years. We have learned that when glass shells fail from excess stress (both compressive and tensile), they emit a pressure pulse. Filled shells, for example, when removed from the pressurization chamber, can be heard popping from across a room, if filled to a pressure beyond the strength of the glass walls to contain it. This pressure pulse provides a signal for detecting failure during testing. Recently Pennwalt Corporation has advertised a new piezo- and pyroelectric material it calls KYNAR{reg<-sign}, a thin film made of polyvinylidene fluoride. This material has unusually high piezoelectric response, and seemed a good candidate sensor to detect the buckling collapse of glass shells. 2 figs.

50235 **(PNL-SA—15681) Effects of irradiation on low activation ferritic alloys: A review.** Gelles, D.S. (Pacific Northwest Lab., Richland, WA (USA)). 23 Mar 1988. Contract AC06-76RL01830. 22p. (CONF-8806198—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014760/JAW.

From International symposium on reduced activation alloys for fusion service; Andover, MA, USA (29 Jun 1988).

A broad range of ferritic alloys is possible which satisfy the low activation requirement for near-surface burial of fusion reactor materials after decommissioning. Low activation bainitic alloys in the Fe-2Cr composition range, martensitic alloys in the Fe-7 to 9Cr range and stabilized martensitic alloys in the Fe-12Cr range have been successfully fabricated and are undergoing testing as demonstrated by efforts in Europe, Japan and the United States. However, it is found that irradiation significantly degrades the properties of bainitic and stabilized martensitic alloys. Bainitic alloys containing vanadium develop severe hardening due to irradiation-induced precipitation at temperatures below 450{degree}C and extreme softening due to carbide coarsening at temperatures above 500{degree}C. Stabilized martensitic alloys which rely on manganese additions to provide a fully martensitic microstructure are embrittled at grain boundaries following irradiation leading to severe degradation of impact properties. The most promising composition regime appears to be the FE-7 to 9 Cr range with tungsten additions in the 2% range where high temperature mechanical properties and microstructural stability are retained and impact properties are relatively unaffected by irradiation. 25 refs., 9 figs. , 3 tabs.

50236 **(PPPL—2548) Computer-aided methods of determining thyristor thermal transients.** Lu, E.; Bronner, G. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1988. Contract AC02-76CH03073. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015826/JAW.

An accurate tracing of the thyristor thermal response is investigated. This paper offers several alternatives for thermal modeling and analysis by using an electrical circuit analog: topological method, convolution integral method, etc. These methods are adaptable to numerical solutions and well suited to the use of the digital computer. The thermal analysis of thyristors was performed for the 1000 MVA converter system at the Princeton Plasma Physics Laboratory. Transient thermal impedance curves for individual thyristors in a given cooling arrangement were known from measurements and from manufacturer's data. The analysis pertains to almost any loading case, and the results are obtained in a numerical or a graphical format. 6 refs., 9 figs.

50237 **(SAND—87-3040C) Flexural fatigue of a 2-D carbon/carbon composite material.** Guess, T.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 15p. (CONF-880909—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88010501/JAW.

From 20. international conference of the Society for the Advancement of Materials and Process Engineering; Minneapolis, MN, USA (27 Sep 1988).

An experimental study of the static and cyclic fatigue response of a quasi-isotropic carbon/carbon composite was conducted. This 16-ply carbon fabric/carbon matrix composite is a candidate material for use as RF antenna shield limiters in the Tokamak Fusion Test Reactor, Princeton, NJ. In this application, the material will be subjected to bending loads and must withstand 100,000 cycles without failure. The experimental approach was to use the four-point flexural test to evaluate both static and fatigue properties of the material at room temperature. For the static tests, beam specimens were strain gaged on both the tension and compression sides and loaded to failure. This composite had identical moduli in tension and compression (9.4 million psi) and an apparent flexural strength of about 27.6 ksi; specimen yielding began between 17 and 19 ksi. Cyclic fatigue tests were conducted under sinusoidal load control at different levels of stress amplitude. Each cyclic test was continued until either fatigue failure occurred or 100,000 cycles were reached. Those specimens reaching 100,000 cycles without failure were subsequently loaded to failure for measurement of residual flexural strength. The experimental fatigue data appear to be linear when plotted as an S-N curve (flexural stress vs. log N), where N is the number of cycles to failure. When the maximum flexural stress was less than about 70% of the static flexural strength, the carbon/carbon composite had a fatigue life greater than 100,000 cycles. Also, it was found that those specimens which did not fail in the first 100,00 cycles had residual strengths equal to specimens loaded to failure on the first cycle. 7 figs., 2 tabs.

50238 **(UCRL—21074) Strategic action plan to achieve quality assurance for NOVA laser operations.** (Lawrence Livermore National Lab., CA (USA); BDM Corp., Albuquerque, NM (USA)). 11 Jan 1988. Contract W-7405-ENG-48. 124p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88013817/JAW.

With a detailed outline of key areas of concentration defined for quality assurance enhancements, this document is a tool prepared expressively for NOVA Operations personnel to develop adequate checks and balances leading to effective optics production. This document provides an understanding for the recommended quality assurance program scope, goals, needs and requirements. Also included is a strategy for each requirement, a rough order of magnitude estimate of program impact (in terms of savings for NOVA operations) and an appendix containing data collected and analyzed. During the initial assessment and data collection activities primary attention was focused in the areas of management, technology, and procedures. As the assessment results were more clearly defined, the needs and requirements were categorized in the general area of: organizational interface; information and information systems; tools, methods and facilities; and acceptance criteria. Each of these areas were further detailed to establish an understanding of how the baselines quality assurance program scope should be structured. 14 figs.

50239 **(UCRL—99168) A novel alignment technique for pointing and centering optical components.** Ellis, R.J. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 4p. (CONF-880887—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015441/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

A relatively simple technique was devised to precisely align the components of a diagnostic instrument which recorded the first neutron images of imploding laser fusion targets. Alignment was achieved using a laser, a 2 mm diameter glass sphere, and a pair of lenses. With this technique, a 6 cm long aperture was pointed with an accuracy of 68 microradians and coaxially aligned with a target and detector separated by 10.5 meters. The alignment technique is described and critical features are discussed. 2 refs., 3 figs.

50240 **Species and divergence measurements on the TFTR diagnostic neutral beam.** Gammel, G.; Fonck, R.J.; Roquemore, A.L.; Schilling, G. (Princeton University, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 8, 1676-1678(Aug 1988).

The ion source of the TFTR diagnostic neutral beam utilizes a magnetic cusp bucket from a PLT source modified with an internal rf antenna in place of filaments. The species mix of the beam has been measured after the neutralizer as a function of several parameters in two ways: spectroscopically and by an electrostatic charge exchange analyzer. Source and neutralizer gas feeds (both hydrogen) were varied. Some measurements were made with the bending magnet alternately on and off to obtain neutralizer efficiency for each component. Accelerator current was varied, at fixed acceleration voltage and gas feed rate, by varying rf power to the antenna. Relative beam divergence during this scan was monitored by both diagnostics, and an absolute divergence was obtained from a spectroscopic profile scan.

50241 **Stimulated acceleration and confinement of deuterons in focused discharges - Part I.** Nardi, V.; Bortolotti, A.; Brzosko, J.S.; Esper, M.; Luo, C.M.; Pedrielli, F.; Powell, C.; Zeng, D. (Stevens Institute of Technology, Hoboken, NJ (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 3, 368-373(Jun 1988).

Acceleration and confinement of megaelectronvolt D/sup +/ ions in the plasma focus (PF) are analyzed in terms of the observed energy spectrum of the ejected ions and of the energy spectrum of the D-D neutrons from which the trapped-ion spectrum is derived. The current distribution in the interelectrode gap can be modified by field distortion elements (FDE's) which increase the fraction of the total electrode current flowing in the pinch. An optimized FDE increases the observed maximum value, Max Y/sub n/, and the mean value Y-bar/sub n/, of the observed D-D neutron yield per shot Y/sub n/ by a factor ≥ 3. The ejected-ion spectrum is determined by three dependent methods (Thomson spectrometers, high-resolution magnetic analyzer/filters, and Faraday cups).

50242 **Microscopic and macroscopic material property effects on ultraviolet-laser-induced flashover of angled insulators in vacuum.** Enloe, C.L.; Gilgenbach, R.M. (Intense Energy Beam Interaction Lab., Dept. of Nuclear Engineering, Univ. of Michigan, Ann Arbor, MI (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 3, 379-389(Jun 1988).

Flashover of electrically stressed polymeric insulators in vacuum has been induced by ultraviolet radiation from an excimer laser (KrF). Flashover behavior is a relatively strong function of integrated fluence up to the time of flashover initiation, and virtually independent of applied power or pulse time. Flashover is induced by moderate fluence (10 - 150 mJ/cm/sup 2/) of intense (0.4 - 6 MW/cm/sup 2/) ultraviolet at 248 nm at electric field stress considerably below the static breakdown stress. The critical fluence required to initiate flashover is a function of the electric field stress, the insulating material, and the geometry of the dielectric/vacuum interface. The unconventional insulator geometry (in which elec-

trons are accelerated toward the insulator surface) is more tolerant than the conventional geometry by nearly a factor of 2 in fluence. Insulator materials tested were polyethylene, polystyrene, acrylic, nylon-6, acetal, PVC, and teflon. The critical fluence is correlated to the microscopic and macroscopic material properties; results show that insulating materials with high dielectric constants and low secondary electron emission coefficients exhibit superior tolerance to ultraviolet radiation. Of the materials tested, nylon exhibited the highest critical fluence in both the conventional and the unconventional geometries. A theory of ultraviolet-induced insulator flashover is developed.

50243 **Stimulated acceleration and confinement of deuterons in focused discharges - Part II.** Nardi, V.; Bilbao, L.; Brzosko, J.S.; Powell, C.; Zeng, D.; Bortolotti, A.; Mezzetti, F.; Robouch, B.V. (Stevens Institute of Technology, Hoboken, NJ (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 3, 374-378(Jun 1988).

New methods of increasing, by a factor greater than 5, the neutron yield/shot Y/sub n/ from D-D fusion reactions in a plasma" focus (PF) enhance both the D/sup +/-ion acceleration to energy values E > 1-8 MeV and the in confinement in the pinch region. Nuclear activation of C and N in the (doped) filling gas of the discharge chamber and of solid targets of C and BN bombarded by the ion beam in the direction of the electrode axis (0°) confirms earlier determination of the energy spectrum of the trapped ions (dphi/sub t//dE ∞ phi/sub 0t/E/sup -m/) and of the ejected beam (dphi/sub b//dE ∞ phi/sub 0b/E/sup -m/, m = 2.5 +- 0.5 for 0.1 MeV ≦ E ≦ 3 MeV). A Thomson (parabola) spectrometer with nanosecond time resolution determines the time of emission t (E) of the beam at 0°. Ion acceleration and trapping occur within the small (filamentary) elements of the magnetic field structure of the pinch, which can be dispersed on a relatively large confinement volume after the pinch disintegration. The authors find that phi/sub t//phi/sub b/ ≧ 10-10/sup 3/ for E ≦ 1 MeV, depending on Y/sub n/.

50244 **High peak power K/sub a/-band gyrotron oscillator experiments with slotted and unslotted cavities.** Gold, S.H.; Fliflet, A.W.; Manheimer, W.M.; McCowan, R.B.; Lee, R.C.; Granatstein, V.L.; Hardesty, D.L.; Kinkead, A.K.; Sucy, M. (High Power Electromagnetic Radiation Branch, Plasma Physics Div., Naval Research Lab., Washington, DC (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 2, 142-148(Apr 1988).

A K/sub α/-band gyrotron oscillator powered by a compact pulse-line accelerator has been operated using oscillator cavities with and without axial slots. The use of axial slots has been shown to suppress low starting current "whispering-gallery" modes, in particular, modes of the TE/sub m2/ type, allowing stable operation in a linearly polarized TE/sub 13/ mode. A peak power of 35 MW has been observed at 6-percent efficiency.

50245 **Self-consistent simulation of cyclotron autoresonance maser amplifiers.** Pendergast, K.D.; Danly, B.G.; Temkin, R.J.; Wurtele, J.S. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, MA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 2, 122-128(Apr 1988).

A self-consistent, one-dimensional model of the cyclotron autoresonance maser (CARM) amplifier is developed, and numerical simulations based on this model are described. Detailed studies of the CARM gain and efficiency for a wide range of initial energy and velocity spreads are presented. The interaction efficiency is found to be substantially increased when the axial magnetic field is tapered. For example, efficiencies of greater than 41 percent are obtained for a 140-GHz CARM amplifier with a tapered axial magnetic field and a 700-kV 4.5-A electron beam with parallel velocity spreads of less than 1 percent. A discussion of the nonlinear bandwidth and interaction sensitivity to axial field inhomogeneities is presented.

50246 **Particle simulation of a high-power gyrotron oscillator.** Lin, A.T.; Yang, Z.H.; Chu, K.R. (Dept. of Physics, Univ. of California at Los Angeles, Los Angeles, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 2, 129-134(Apr 1988).

A self-consistent and time-dependent code has been developed to simulate the beam-wave dynamics in a gyrotron oscillator. Simulation results are presented on the efficiency, the self-consistent field profile, and the scaling of the transient growth rate with the beam current. At high beam currents, the output wave exhibits the effects of self-modulated oscillation and period doubling.

50247 **Simulation of transient behavior in a pulse-line-driven gyrotron oscillator.** Lin, A.T.; Lin, C.C.; Yang, Z.H.; Chu, K.R.; Fliflet, A.W.; Gold, S.H. (Dept. of Physics, Univ. of California at Los Angeles, Los Angeles, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **16**: No. 2, 135-141(Apr 1988).

A slow-time-scale single-mode simulation and a fast-time-scale multimode particle code have been used to simulate the transient behavior in a pulse-line-driven high peak power gyrotron oscillator. Both slow- and fast-time-scale single-mode simulations are found to be in good general agreement with the fast-rise-time wave generation processes theorized in an earlier experiment, while some discrepancies are found between the fast-time-scale multimode simulations and the experimental observations. The multimode simulation points out the possibility of transient mode suppression and mode competition processes which appear to be of general interest for short-pulse gyrotrons.

50248 **Tiber Engineering Test Reactor (ETR) startup scenarios.** Blackfield, D.T.; Perkins, L.J. (Lawrence Livermore National Lab., P.O. Box 5511, L-644, Livermore, CA (US)). pp 1345-1348 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

A time-dependent Tokamak Systems Code (TSC) has been developed and used to examine various inductively driven startup scenarios for the TIBER reactor. Radially averaged particle and energy balance equations are solved. In addition, time varying currents in the PF and OH coils are determined from MHD equilibrium and volt-seconds considerations. Less than 20 MW of auxiliary power deposited in the electrons is required to obtain steady-state operations. For this scenario, less than 10% of the total volt-seconds capability is consumed during startup and the currents in the PF and OH coils do not appear to exceed stress limits. For every volt-second saved during startup, the burn time can be extended 14 seconds.

50249 **Compact Ignition Tokamak conventional facilities optimization.** Commander, J.C.; Spang, N.W. (Idaho National Engineering Lab., EG and G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID (US)). pp 1325-1328 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

A high-field ignition machine with liquid-nitrogen-cooled copper coils, designated the Compact Ignition Tokamak (CIT), is proposed for the next phase of the United States magnetically confined fusion program. A team of national laboratory, university, and industrial participants completed the conceptual design for the CIT machine, support systems and conventional facilities. Following conceptual design, optimization studies were conducted with the goal of improving machine performance, support systems design, and conventional facilities configuration. This paper deals primarily with the conceptual design configuration of the CIT conventional facilities, the changes that evolved during optimization studies, and the revised changes resulting from functional and operational requirements (F and ORs). The CIT conventional facilities conceptual design is based on two premises: (1) satisfaction of the F and

ORs developed in the CIT building and utilities requirements document, and (2) the assumption that the CIT project will be sited at the Princeton Plasma Physics Laboratory (PPPL) in order that maximum utilization can be made of existing Tokamak Fusion Test Reactor (TFTR) buildings and utilities. The optimization studies required reevaluation of the F and ORs and a second look at TFTR buildings and utilities. Some of the high-cost-impact optimization studies are discussed, including the evaluation criteria for a change from the conceptual design baseline configuration. The revised conventional facilities configuration are described and the estimated cost impact is summarized.

50250 **Mechanical design aspects of the Advanced Toroidal Facility Thomson scattering diagnostic.** Shipley, W.D.; Kindsfather, R.R.; Rasmussen, D.A. (Martin Marietta Energy Systems, Inc., P.O. Box Y, Oak Ridge, TN (US)). pp 1297-1300 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

A two-dimensional (2-D) Thomson scattering system has been designed for the Advanced Toroidal Facility (ATF), a torsatron experiment at the Oak Ridge National Laboratory (ORNL). The system is a modification of the Thomson scattering system used on the Impurity Study Experiment (ISX-B) tokamak. It will provide measurements of electron temperature (T/sub e/) and density (eta/sub e/) at 15 points along a vertical chord. With multiple shots, a 2-D T/sub e/ and eta/sub e/ map of a toroidal cross section of ATF can be obtained. The horizontal Thomson scattering viewing port is offset by 15° toroidally from the ports through which the vertical laser beam passes. The modifications to the ISX-B Thomson scattering system are either changes required to adapt the system to the ATF device geometry or changes that result in improvements to the original system. This paper deals with the mechanical design aspects of the laser light baffle plates that reduce the amount of extraneous light entering the plasma, the upper and lower vacuum extensions that contain the baffles and attach to the ATF vacuum vessel, the entrance window assembly, the laser dump assembly, the viewing window and shutter assembly, and the alignment target mechanism and drive used to determine the mapping of data points in the plasma cross section.

50251 **The TITAN-II, reversed-field pinch aqueous fusion power core design.** Wong, C.P.C.; Creedon, R.L.; Grotz, S.P.; Cheng, E.T.; Sharafat, S.; Cooke, P.I.H.; Bartiit, J.B.; Bathke, C.G.; Blanchard, J.P.; Chu, Y. (The TITAN Research Group (US)). pp 1287-1291 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

During the TITAN Reversed-Field Pinch reactor study, the authors investigated the aqueous lithium solution loop-in-pool design, TITAN-II, which operates at a neutron wall loading of 18 MW/m/sup 2/. The tritium breeding material is an aqueous solution of LiNO/sub 3/. Reduced-activation, high-strength 9-C ferritic steel is used for the structure. An integrated first wall and blanket design in lobe geometry was selected for the torus configuration. Subcooled flow boiling heat transfer is needed for the removal of the high surface heat flux. At a concentration of 5 at.% of lithium in water, the 1-D tritium breeding ratio is 1.22. The selected power conversion system is the state-of-the-art fission PWR design. Based on the selected materials and design, this aqueous blanket can be considered a near-term design. To make the design passively safe, the complete fusion power core and the primary coolant system are submerged in a pool of low-temperature, low-pressure water. Under the scenario of the worst loss-of-coolant accident (LOCA), the pool of water can be used to dilute the reactor thermal and afterheat energy, thus eliminating the possibility of radioactivity release to the public. Preliminary results indicate that this near-term aqueous loop-in-pool design can be passively safe and has the potential of requiring minimum development cost.

50252 **Incorporating reliability into the design of experimental fusion facilities.** Cadwallader, L.C.; Holland, D.F. (Idaho National Engineering Lab., EG and G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID (US)). pp 1262-1266 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

This paper presents risk-based design objectives for the Compact Ignition Tokamak (CIT) and gives ideas for risk-reducing design practices that can be incorporated into CIT design. A preliminary analysis for the identification of critical, nonrepairable CIT components is also presented.

50253 **Software quality assurance - seven years experience.** Malsbury, J.A. (Princeton Plasma Physics Lab., Princeton Univ., P.O. Box 451, Princeton, NJ (US)). pp 1251-1253 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

This paper describes seven years experience with software quality assurance at PPPL. It covers the early attempts of 1980 and 1981 to establish software quality assurance; the first attempt of 1982 to develop a complete software quality assurance plan; the significant modifications of this plan in 1985; and the future. In addition, the paper describes the role of the Quality Assurance organization within each plan. The scope of this paper is limited to discussions of the software development procedures used in the seven year period. Other software quality topics, such as configuration control or problem identification and resolution, are not discussed.

50254 **Blanket module testing in TIBER II.** Mattas, R.; Baker, C.; Cha, Y.; Finn, P.; Majumdar, S.; Picologlou, B.; Stevens, H.; Sze, D.K.; Turner, L.R.; Abdou, M. (Argonne National Lab., 9700 S. Cass Avenue, Argonne, IL (US)). pp 1279-1282 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

The overall results of a multi-laboratory effort to develop blanket module test schedules and requirements for the ITER/TIBER reactor are summarized. The different blanket concepts that have been addressed are self-cooled liquid metal blankets, water-cooled blankets, helium-cooled blankets, self-cooled Flibe blankets, and water/Li-salt blankets. In each case, a specific blanket design was chosen as an example for a test module, and subsystem requirements were determined. A test matrix, based upon key issues for blanket operation, the required test environments and test times, and the ITER/TIBER operating schedule, was formulated for each blanket type.

50255 **Nuclear modules of ITER tokamak systems code.** Gohar, Y.; Baker, C.; Brooks, J.; Finn, P.; Hassanein, A.; Willms, S.; Barr, W.; Bushigin, A.; Kalyanam, K.M.; Haines, J. (Argonne National Lab., 9700 S. Cass Ave., Argonne, IL (US)). pp 1271-1278 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

Nuclear modules were developed to model various reactor components in the ITER systems code. These modules include first wall, tritium breeding blanket (or shield), bulk shield, reactor vault, impurity control, and tritium system. The function of these modules is to define the performance parameters for each component as a function of the reactor operating conditions. Several design options and cost algorithms are included for each component. The first wall, blanket and shield modules calculate the beryllium zone thickness, the disruptions results, the nuclear responses in different components including the toroidal field coils. Tungsten shield/water coolant/steel structure and steel shield/water coolant are the shield options for the inboard and outboard sections of the reactor. Lithi-

um nitrate dissolved in the water coolant with a variable beryllium zone thickness in the outboard section of the reactor provides the tritium breeding capability. The reactor vault module defines the thickness of the reactor wall and the roof based on the dose equivalent during operation including skyshine contribution. The impurity control module provides the design parameters for the divertor including plate design, heat load, erosion rate, tritium permeation through the plate material to the coolant, plasma contamination by sputtered impurities, and plate lifetime. Several materials: Be, C, V, Mo, and W can be used for the divertor plate to cover a range of plasma edge temperatures. The tritium module calculates tritium and deuterium flow rates for the reactor plant. The tritium inventory in the fuelers, neutral beams, vacuum pumps, impurity control, first wall, and blanket is calculated. Tritium requirements are provided for different operating conditions. The nuclear models are summarized in this paper including the different design options and key analyses of each module.

50256 **The edge plasma and divertor in tiber.** Barr, W.L. (Lawrence Livermore National Lab., Livermore, CA (US)). pp 1341-1344 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

An open divertor configuration has been adopted for TIBER. Most recent designs, including DIII-D, NET and CIT use open configurations and rely on a dense edge plasma to shield the plasma from the gas produced at the neutralizer plate. Experiments on ASDEX, PDX, D-III, and recently on DIII-D have shown that a dense edge plasma can be produced by re-ionizing most of the gas produced at the plate. This high recycling mode allows a large flux of particles to carry the heat to the plate, so that the mean energy per particle can be low. Erosion of the plate can be greatly reduced if the average impact energy of the ions at the plate can be reduced to near or below the threshold for sputtering of the plate material. The present configuration allows part of the flux of edge plasma ions to be neutralized at the entrance to the pumping duct so that helium is pumped as well as hydrogen. This configuration has the following features: Peak heat loads of about 3 MW/m/sup 2/, and less than 4.5 MW/m/sup 2/ even if the plasma shifts position by as much as 0.1 m in any direction. High gas recycling to reduce sputtering and the erosion of the plates and the production of impurity ions. Small vacuum ducts made possible by the high pressure in the ducts that results from the high recycling. Pumping speed is 50 m/sup 3//s and pressure in the vacuum ducts is 40 mTorr. At least 0.48m of neutron shielding between plasma and the superconducting magnets.

50257 **Alex results - A comparison of measurements from a round and a rectangular duct with 3-D code predictions.** Reed, C.B.; Picologlou, B.F.; Hua, T.Q.; Walker, J.S. (Fusion Power Program, Argonne National Lab., 9700 South Cass Avenue, Argonne, IL (US)). pp 1267-1270 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

Recent results of liquid-metal magnetohydrodynamic (MHD) measurements from a rectangular duct and earlier measurements from a round duct are reported. A fully three-dimensional numerical analysis of each test section in the fringing region of an applied magnetic field is briefly described. The results of the experiments and the 3-D code predictions are compared and discussed. Excellent agreement is obtained in both test section geometries for interaction parameters ranging from $500 \leq N \leq 1.25 \times 10/\text{sup } 5/$.

50258 **Facilities design for TIBER II.** Thomson, S.L.; Blevins, J.D. (Fusion Engineering Design Center/Bechtel National, Inc., P.O. Box Y, Oak Ridge, TN (US)). pp 1322-1324 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

This paper describes the conceptual design of the reactor building and reactor maintenance building for the TIBER II tokamak. These buildings are strongly influenced by the reactor configuration, and their characterization allows a better understanding of the economic and technical implications of the reactor design. Key features of TIBER II that affect the facilities design are the small size and compact arrangement, the use of an external vacuum vessel, and the complete reliance on remote maintenance. The building design incorporates requirements for equipment layout; maintenance operations and equipment; safety; and contamination control.

50259 **Quality and reliability management for CIT.** Camp, R.A.; Howard, H.P. (Princeton Plasma Physics Lab., Princeton Univ., P.O. Box 451, Princeton, NJ (US)). pp 1254-1257 of Proceedings of the 12th symposium on fusion engineering. Piscataway, NJ; IEEE Service Center (1987). (CONF-871007—).

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

This paper provides an overview of the Compact Ignition Tokamak (CIT) Quality and Reliability Program, including the organizational roles and responsibilities as well as the quality, reliability, and maintainability requirements imposed on the project. It also identifies the major issues that have driven the Project to adopt this approach and discusses the unique aspects of CIT, both organizational and physical, that relate to quality and reliability. In addition to the adoption of the basic quality requirements of ASME/ANSI NQA-1-1986, there are a number of extended requirements such as adopting IEEE 730 for software quality assurance, and other prepared standards for electronic workmanship and component cleanliness. The divergence of reliability requirements for CIT as compared to earlier tokamak devices (specifically TFTR) is directly related to the operating environment which will preclude, or seriously inhibit, hand on maintenance and repair within the immediate machine core area. Failures which were once readily accommodated, could result in loss-of-mission unless redundancy, remote maintenance designs, or other fault accommodating provisions are developed. A broad spectrum of reliability engineering strategies, including mission analysis, failure modes effects and criticality analyses, fault and event trees, and reliability demonstration, and utilized and brought to bear in a consistent and meaningful manner. Their applicability and relationship to similar strategies involving safety and environmental issues is presented along with some preliminary results.

99 GENERAL AND MISCELLANEOUS

50260 **(HMI-B—448) Lise Meitner - a biography.** Krafft, F. (Mainz Univ. (Germany, F.R.). Fachbereich 17 - Mathematik). (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). Jan 1988. 25p. (In German). Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.).

This report is a publication of a colloquium paper as to the personality of Lise Meitner.

9901 Management

REFER ALSO TO CITATION(S) 48616, 49401, 50069, 50305, 50342

50261 **(ANL/EES-TM—348) A decision-analysis methodology for priority-ranking and comparing international collaborative research and development activities.** Buehring, W.A.; Gillette, J.L.; Szpunar, C.B.; Whitfield, R.G. (Argonne National Lab., IL (USA). Energy and Environmental Systems Div.). Jun 1988. Contract W-31109-ENG-38. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015516/JAW.

A methodology for evaluating and comparing proposed collaborative international research and development (R&D) activities has been developed for the US Department of Energy, Office of the Assistant Secretary for Fossil Energy (DOE/FE). The objective of the methodology is to rank proposed agreements in order of highest desirability for DOE/FE participation. Agreements are as-

sessed in terms of six attributes: (1) probability of achieving agreement-specific objectives, (2) US balance-of-trade effects, (3) joint commitment of the R&D partners, (4) distribution of anticipated benefits from the R&D, (5) professional challenge and worthiness of the R&D, and (6) level of industrial participation. These attributes were defined by examining 71 agreements and interviewing individuals experienced in international coal research activities mostly present or former DOE personnel. For each agreement, numerical levels of achievement under each attribute are estimated and then inserted into 11 multiattribute utility functions, which reflect 11 expert opinions regarding the relative importance of each attribute. The outcome consists of 11 sets of expected-utility scores, which are averaged and arranged in descending order as a basis for ranking the agreements. A trial application of the methodology, involving 22 closed agreements, produced usable, reasonable results. 15 refs.

50262 **(BDX—613-3933) Implementing and sustaining quality improvements: Management methodology for managing change.** Thompson, C. Jr. (Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.). Apr 1988. Contract AC04-76DP00613. 19p. (CONF-880944—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88008322/JAW.

From World Confederation of Productivity Science meeting; Montreal, Canada (25 Sep 1988).

There is total agreement that the greatest problems facing American business today are the decline in productivity growth combined with the inability of some industries to meet their customer's quality and reliability expectations. Two statements describe the response of managers attempting to deal with today's productivity challenges. An increasing number of managers in more organizations than ever before are expending serious, substantive effort on the implementation of quality improvement programs. More managers now view quality as the foundation of strategic importance, rather than as an abstraction to be pulled out of platitude files and given lip service at the annual meetings. Both of these statements are good. What is not so good is that while such improvement programs may lead to some quality improvements, what progress is made tends to be less substantial and the improvements are not sustained over long periods of time to reflect overall productivity improvement. 4 figs.

50263 **(BDX—613-3940) Instilling a quality mindset.** O'Dell, R.E.; Lyon, T.L. (Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.). Apr 1988. Contract AC04-76DP00613. 36p. (CONF-880944—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88008888/JAW.

From World Confederation of Productivity Science meeting; Montreal, Canada (25 Sep 1988).

In 1983 Allied-Signal Inc., Kansas City Division (henceforth referred to as KCD), responsible for the production and procurement of components of weapon systems, intiated quality improvement activities. Although the company has historically received excellent quality performance ratings from the government, management realized that they faced increased competition both domestically and internationally for their business and that some form of continuous improvement process was necessary. Their initial efforts in 1983 were aimed at increasing the level of first acceptance of products. First acceptance is defined by the supervisory staff as the percentage of product that conforms to specification on first inspection. These initial efforts included an increased emphasis on quality at the hourly worker and inspection levels; specific quality improvement teams were established in areas where a higher number of defects had been found in the past. These activities were focused at the line and operating personnel levels rather than on an organization-wide basis. The goal of these efforts was to decrease the percentage of defects. 64 refs., 1 fig.

50264 **(DOE/IG—0257) Audit of the Operational Model satellite telecommunications system.** (USDOE Office of Inspector General, Washington, DC. Capital Regional Office). Aug 1988. 28p. OSTI, PO Bx 62, Oak Ridge, TN 37831-Available from OSTI; 1; GPO Dep. Order Number DE88015869/JAW.

The Operational Model (OPMODEL) system carries data and voice communications between four Department of Energy (DOE) Defense Programs locations via satellite. As of June 1987, this configuration had been operational for 1 year at an annual cost of $3.1 million. In late June 1987, the department was considering expanding OPMODEL by adding two more locations and a larger transmission capacity, which would increase annual costs to $7.8 million. The purpose of our audit was to determine the cost effectiveness of OPMODEL in its present and expanded configurations. The audit concludes that the OPMODEL system is less cost effective than existing land-based systems.

50265 **(DOE/MA/00356—H2) 1988 national compensation survey of research and development scientists and engineers: Final report: Data effective date, January 15, 1988.** (Hay Group, Washington, DC (USA)). May 1988. Contract AC01-86MA00356. 419p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE88015868/JAW.

This report presents the results of the second in a new series of surveys of compensation and benefits for research and development (R & D) scientists and engineers (S & Es). The 1988 Survey represents the largest nationwide database of its kind, covering 105 establishments which provided data on more than 36,000 degrees researchers in the {open←quotes}hard{close←quotes} sciences. The focus is on medium- and large-sized establishments which employ at least 100 degreed S & Es in R & D. The 1988 Survey contains data which cover about 16% of all establishments eligible to participate, encompassing approximately 15% of all eligible employees. As in 1987, the survey sample constitutes a fairly good representation of the entire population of eligible establishments on the basis of business sector, geographic location, and size. Maturity-based analyses of salaries for some 31,000 non-supervisory researchers are provided, as are job content-based analyses of more than 25,000 individual contributors and over 5000 first level supervisors and division directors. Compensation policies and practices data are provided for 88 establishments, and benefits costs for 81 establishments are analyzed.

50266 (INIS-BR—1147-Vol.2, pp 111-114) **Could Salviati, the teacher, exist.** Almeida, E.S. de; Mello, S.P. (Universidade Federal Fluminense, Niteroi (Brazil). Inst. de Fisica). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

We see the things and say - why we imagine the things and say - why not/sup (*/) why not a software teaching nuclear energy which links fantasy and reality. Combining 3 characters of the world of imagination: Salviati a teacher dog, Saegredo a curious duck and Simplicio an importunate mouse; with basic facts and datas about nuclear energy, we obtain a software agile, creative and innovator, that stimulate the curiosity and imagination - mainly, it help us to understand and to comprehend one of the most polemics themes of our era.

50267 (INIS-BR—1147-Vol.2, pp 423-431) **Activities of the Laboratory of Neutron Activation Analysis in the Radiochemistry Division - IPEN/CNEN/SP/Brazil.** Vasconcellos, M.B.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703248/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

Neutron activation analysis (NAA) is one of the relevant applications of nuclear research reactors. Due to the high neutron fluxes available in these reactors, an excellent sensitivity of analysis is attained for many elements. NAA is one of the most sensitive, precise and accurate analytical methods for trace element determination. NAA has been one of the main activities of the Radiochemistry Division of IPEN, since the befinning of the operation of the nuclear reactor IEA-R1. Most of the effort was devoted to research work, aimed to improvements in the method as well as to its applications to several kinds of matrixes (geological, biological, metallic, environmental, forensic). Besides, analytical services were also of-

fered, to the CNEN, to industries, universities, mining companies and research institutes. In the present paper, a review is made of the research work being developed presently at the Radiochemistry Division of IPEN. A discussion is also made of the planned expansion of the analytical services offered.

50268 **(INIS-mf—11779) Karlsruhe Nuclear Research Center. Research and development programme 1988. As of September 7, 1987.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1987. 480p. (In German). NTIS (US Sales Only), PC A21/MF A01; GPO Dep. Order Number DE88754596/JAW.

A general survey of planned activities and developmental trends of the nuclear research centre is followed by a more detailed account of projects and goals. The various institutes and laboratories are presented together with their specific task schedules.

50269 **(Juel-Spez—433) Early recognition of technological opportunities. Realization and perspectives.** Stegelmann, H.U.; Peters, H.P.; Stein, G.; Muench, E. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Technik und Gesellschaft). Mar 1988. 70p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754666/JAW.

In cooperation with the American consulting company Arthur D. Little, a number of procedures, including evaluation of literature data banks, expert interviews and expert workshops, were tried. A three-step concept was finally developed involving identification of candidate technologies (identification), collection of information on these candidates (exploration), ultimately leading to an assessment of the candidate technologies (evaluation). Such a procedure basically enables long-term observation of the scientific policy decisions. This information may serve to identify the deficits and strength of the German scientific system in comparison to that of other countries. Such a system permits the survey and documentation of scientists' subjective expectations on the trends of technology developments and the associated economic and other social consequences. It became apparent that this concept should not raise expectations too high and that it is not essentially different from the advisory instruments already employed today (advisory councils, expert consultants), but rather that these established procedures are merely systematized and supplemented by further information sources (e.g. data banks). In implementing this study two central sets of problems were identified which must be overcome: The early recognition of opportunities is in the long run based on analysts infiltrating the existing network of specialist scientists and examining the information in circulation there with respect to the aims of early recognition so that access to this network is a decisive requirement for an institutionalization of early recognition; incentive systems must be created motivating scientists to become actively involved in the early recognition of technological opportunities.

50270 **(LA-UR—88-1996) Nuclear technology and the export control laws.** Lundy, A.S.; Pankratz, M.C.; Hogsett, V.H.; Munroe, J.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-880631—41). NTIS, PC A02. Order Number DE88014431/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Three basic US laws regulate the export of commodities, services, and technical data. People working in nuclear fields need to know of these laws and their impact on professional endeavors. Export of technical data means the communication may be a model, blueprint, sketch, or any other device that can convey information. If the data relates to items on one of the control lists, a license must be sought from the appropriate federal agency. The Militarily Critical Technologies List (MCTL), though not itself a control list, plays a major role in determining what technical data will require a validated license. The US Department of Energy (DOE), through Technical Working Group (TWG) 11, is responsible for the Nuclear Technology chapter of the MCTL. TWG 11 also prepares the Nuclear Technology Reference Book (NTRB), a classified guide to sensitive nuclear technology.

50271 **(OEFZS-A—1209) Information on governmental and industrial energy RD and D expenditures for the period 1984 until 1987 in Austria.** Faninger, G. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Hauptabteilung Umweltplanung). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). May 1988. 87p. (In German). (NU—68/88). Austrian Research Centre Seibersdorf, A-2444 Seibersdorf, Austria.

Limited distribution.

The results of a statistical census are given in global as well as in detailed form (for several institutions) for different energies, among them for nuclear energy. A part of the global data is given back up to 1977. 48 tabs. (qui).

50272 **(PNL-SA—14982) Technical auditors: A positive response for auditing.** Frank, N.C.; Voigt, J.V. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1987. Contract AC06-76RL01830. 7p. (CONF-880571—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012694/JAW.

From 42. ASQC annual quality congress on quality - positive response to the challenge; Dallas, TX, USA (9 May 1988).

Auditing a research and development (R&D) organization has some unique human relations aspects that must be taken into account when developing and implementing a quality auditing program. This paper describes the implementation of an effective audit program at Pacific Northwest Laboratory for their licensing-related R&D work. The performance of an audit is destined for mediocrity and perhaps failure (from the auditee's viewpoint) if the audit team is comprised solely from the "Audit Group." Employees view personnel from the "Audit Group" with distant suspicion because the Audit group is not involved in the day-to-day technical work, the Audit Group is not subject to the cost and schedule pressures of the technical work, and often the auditors are not strong technically in the area being audited. Many of the employees in an R&D organization hold advanced degrees have become nationally and internationally known and respected for their work. For these and other reasons the employees sometimes do not hold the Auditors' opinions in the same high regard as they hold the opinions of peers in their profession. Adding a person who is technically competent in the area being audited and who is respected (both for technical and managerial competence) by the group being audited adds validity to the audit, the audit team, and the audit report. Employees see the technical person as sympathetic to their pressures and understanding of the problems of doing R&D work. Responses to the audit report are timely and more complete when the problem is identified by or supported by a peer.

50273 **(PNL-SA—15620) Effect of a 12-hour/day shift on performance.** Lewis, P.M.; Swaim, D.J. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 11p. (CONF-880633—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013184/JAW.

From 4. international conference on human factors and power plants; Monterey, CA, USA (5 Jun 1988).

The operating crews at the Fast Flux Facility near Richland, Washington, changed their rotating shift schedule from an 8- to 12-hour/day work schedule. The primary reason for the change was to reduce the attrition of operators by increasing their job satisfaction. Eighty-four percent of the operators favored the change. Plant performance and safety were not adversely affected. A statistical analysis of 53 operator-related, off-normal events in 28 months concluded that there was no significant difference in either the number or the severity of off-normal events on the 12-hour shift. A statistical analysis of 200,000 log entries concluded that the error rate in completing logs actually declined by 25 percent on the 12-hour shift. Alertness, which was measured using computerized tests of mathematics and logical reasoning, reach a nadir on the first night shift for the 8- and 12-hour schedules alike, which indicates that the primary cause of fatigue was sleep disruption, not cumulative hours of work. All supervisors and 52 percent of the operators believe their crews work more effectively on the 12-hour shift; only 12 percent of the operators believe that their crews work less effectively. The evaluation indicated that the 12-hour shift scheduled is a reasonable alternative to an 8-hour schedule at this facility. 2 refs.

50274 **(SAND—88-1077-Rev.) Sandia National Laboratories and higher education in New Mexico: Summary report.** (Sandia National Labs., Albuquerque, NM (USA)). Jun 1988. Contract AC04-76DP00789. 12p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015063/JAW.

Sandia National Laboratories interacts extensively with colleges and universities in New Mexico. This report summarizes several of these relationships in employee education, research contracts, loaned equipment, temporary employment, and other areas.

50275 **Protocol failures in cryptosystems.** Moore, J.H. (Sandia National Labs., Albuquerque, NM (US)). *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers);* 76: No. 5, 594-602(May 1988).

When a cryptoalgorithm is used to solve data security or authentication problems, it is implemented within the context of a protocol which specifies the appropriate procedures for data handling. The purpose of the protocol is to insure that when the cryptosystem is applied, the level of security or authentication required by the system is actually attained. In this paper, the authors survey a collection of protocols in which this goal has not been met, not because of a failure of the cryptoalgorithm used, but rather because of shortcomings in the design of the protocol. Guidelines for the development of sound protocols will also be extracted from the analysis of these failures.

50276 **Cryptanalysis: A survey of recent results.** Brickell, E.F.; Odlyzko, A.M. (Sandia National Labs., Albuquerque, NM (US)). *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers);* 76: No. 5, 578-593(May 1988).

In spite of the progress in computational complexity, it is still true that cryptosystems are tested by subjecting them to cryptanalytic attacks by experts. Most of the cryptosystems that have been publicly proposed in the last decade have been broken. This paper outlines a selection of the attacks that have been used and explains some of the basic tools available to the cryptanalyst. Attacks on knapsack cryptosystems, congruential generators, and a variety of two key secrecy and signature schemes are discussed. There is also a brief discussion of the status of the security of cryptosystems for which there is no known feasible attack, such as the RDA, discrete exponentiation, and DES cryptosystems.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 49532, 49533, 49534, 50191

50277 **(AD-A—193137/7/XAB) Review of parallel methods for solving sets of linear equations and their application within optimisation algorithms. Interim report No. 1.** Dixon, L.C. (Hatfield Polytechnic (UK). Numerical Optimisation Centre). Nov 1987. 22p. (TR—188). NTIS, PC A03/MF A01.

When solving optimisation problems on a parallel computing system, the first consideration must be to utilize the parallelism to speed up the 95% of the time typically spent in function and gradient evaluations or the division of each function evaluation into a number of parallel tasks. Assuming this prime task has been undertaken effectively, then for efficiency, the other 5% of the computation must also utilize the parallelism available on the system. The dominant remaining calculation is usually the solution of a set of linear equations. In this paper the implication of parallel processing on the solution method for solving linear equations is reviewed.

50278 **(AD-A—193199/7/XAB) Basic data-base operations on the Butterfly Parallel Processor: experiment results. Memorandum report, January-December 1987.** Rosenau, T.J.; Jajodia, S. (Naval Research Lab., Washington, DC (USA)). 4 Mar 1988. 63p. (NRL-MR—6173). NTIS, PC A04/MF A01.

The next phase in speeding up data-base queries will be through the use of highly parallel computers. This paper will discuss the basic data-base operations (select, project, natural join, and scaler aggregates) on a shared-memory multiple instruction stream, multiple data stream (MIMD) computer and the problems associated with implementing them. Some problems associated with getting maximum parallelization are improper data division and hot spots. Improper data division results when the number of tasks does not divide evenly among the processors. Hot spots or contentions occur due to locking if accesses are made to the same segment of a RAMFile and also if attempts are made to get data from the same remote processor at the same time. These algorithms have been implemented on the Butterfly Parallel Processor, and the results of our experiments are described in detail.

50279 **(AD-A—193295/3/XAB) Programming solutions to the algorithm contraction problem. Technical report.** Nelson, P.A.; Snyder, L. (Washington Univ., Seattle (USA). Dept. of Computer Science). Apr 1986. 5p. NTIS, PC A02/MF A01.

Algorithms for the parallel solution of problems are usually designed assuming an unlimited number of processors. Physical parallel machines have a fixed number of processors. The algorithm contraction problem arises when an algorithm requires more processors than are available on the physical machine. This document presents tools for comparing algorithm contractions based on bottle-neck communication paths. The authors apply these tools to minimum, matrix product and sorting.

50280 **(AD-A—193296/1/XAB) Near-optimal speedup of graphics algorithms using multigauge parallel computers. Technical report.** DeRose, T.D.; Snyder, L.; Yang, C. (Washington Univ., Seattle (USA). Dept. of Computer Science). Dec 1986. 13p. NTIS, PC A03/MF A01.

A multigauge computer can have its data path split into independent data paths that execute operations on small data concurrently. This paper explains how certain forms of multigauge processing can be implemented with little cost in hardware; this low cost implementation is illustrated by describing the multigauging of the Quarter Horse microprocessor; and the authors report on the practical applications from graphics for which 95% of the theoretically possible speedup is achieved with this low-cost implementation. It is concluded that, because multigauging can be used with other architectural structures, it is a very low-cost way of exploiting parallelism.

50281 **(AD-A—193298/7/XAB) Hearts: a dialect of the Poker programming environment specialized to systolic computation. Technical report.** Snyder, L. (Washington Univ., Seattle (USA)). Oct 1986. 10p. (TR—86-10-01). NTIS, PC A02/MF A01.

The design of a parallel programming environment specialized to systolic computation is proposed. The system, called Hearts, is a dialect of the Poker parallel-programming environment. The key feature of Hearts that enables it to be a convenient and efficacious facility for writing systolic programs is a novel concept of program that is graphical rather than textual. The use of this program form is illustrated in a full example of the Kung-Leiserson matrix-product algorithm.

50282 **(AD-A—193299/5/XAB) Transparent coprocessor for interprocessor communication in an MIMD computer. Technical report.** Holman, T.J.; Snyder, L. (Washington Univ., Seattle (USA). Dept. of Computer Science). Jan 1987. 17p. NTIS, PC A03/MF A01.

This paper presents the design of a high-performance interprocessor communication coprocessor for non-shared memory MIMD architectures. The design provides efficient interprocessor communication by relieving the computational processor of all communication related activities and by minimizing the overhead of packet assembly and disassembly. A multiprocessing scheme with zero process switch time allows this coprocessor to handle many communication ports with no additional overhead. Logical ports, which allow many computational processes to share the same physical port, are handled automatically by the coprocessor.

50283 **(AD-A—193463/7/XAB) FORCE: (parallel programming language). Interim report.** Jordan, H. (Colorado Univ., Boulder (USA). Computer Systems Design Group). Jan 1987. 44p. (CSDG—87-1). NTIS, PC A03/MF A01.

The FORCE is a parallel programming language and methodology based on the shared memory multiprocessor model of computation. It is an extension to Fortran which allows a user to write a parallel program that is independent of the number of processes executing it and in which the management of processes is suppressed. Multiple instruction streams are managed as a group by operations that synchronize them and allocate work. The system is implemented on several machines as a macro preprocessor which expands FORCE programs into Fortran code for the host system.

50284 **(AD-A—193464/5/XAB) Multiprogramming and the performance of parallel programs. Interim report.** Benten, M.S.; Jordan, H.F. (Colorado Univ., Boulder (USA). Computer Systems Design Group). Jan 1988. 14p. (CSDG—88-2). NTIS, PC A03/MF A01.

Tight synchronization in parallel programs executed on multiprogrammed multiprocessors may result in catastrophic performance losses as a result of the absence of swapped-out processes. Our work introduces a programming methodology that utilizes computational synchronization and avoids tight control-flow synchronization in parallel programs. In this methodology, each phase of the computation is assigned a status that can be ready, blocked or completed, and tasks in each computational phase are self-scheduled to ensure computational progress by the available executing processes. Results obtained indicate that this methodology avoids the catastrophic performance losses resulting from the swapping of processes in multiprogrammed multiprocessors.

50285 **(AD-A—193466/0/XAB) Comparing barrier algorithms. Interim report.** Arenstorf, N.S.; Jordan, H.F. (Colorado Univ., Boulder (USA). Computer Systems Design Group). Jun 1987. 38p. (CSDG—87-3). NTIS, PC A03/MF A01.

A barrier is a method for synchronizing a large number of concurrent computer processes. This paper develops and considers the relative performance of a variety of different barrier algorithms. After considering some basic-synchronization mechanisms, a collection of barrier algorithms with either linear or logarithmic depth will be presented. A graphical model is described that profiles the execution of the barriers and other parallel-programming constructs. This model shows how the interaction between the barrier algorithms and the work that they synchronize can impact their performance. One result is that logarithmic tree structured barriers show good performance-synchronizing fixed-length work; while linear self-scheduled barriers show better performance when synchronizing fixed-length work with an imbedded critical section. The linear barriers are better able to exploit the process skew associated with critical sections. Timing experiments, performed on an eighteen-processor Flex/32 shared-memory multiprocessor, that support these conclusions are detailed.

50286 **(AD-A—193532/9/XAB) Adaptive identification by systolic arrays. Master's thesis.** Willis, P.A. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1987. 69p. NTIS, PC A04/MF A01.

This thesis is concerned with the implementation of an adaptive-identification algorithm using parallel processing and systolic arrays. In particular, discrete samples of input and output data of a system with uncertain characteristics are used to determine the parameters of its model. The identification algorithm is based on recursive least squares, QR decomposition, and block-processing techniques with covariance resetting. Along similar lines as previous approaches, the identification process is based on the use of Givens rotations. This approach uses the Cordic algorithm for improved numerical efficiency in performing the rotations. Additionally, floating-point and fixed-point arithmetic implementations are compared.

50287 **(AD-A—193649/1/XAB) Rendering of surfaces from volume data.** Levoy, M. (North Carolina Univ., Chapel Hill (USA). Dept. of Computer Science). Feb 1988. 15p. NTIS, PC A03/MF A01.

Revision of rept. dated June 1987.

The application of volume-rendering techniques to the display of surfaces from sampled scalar functions of three spatial dimensions is explored. Fitting of geometric primitives to the sampled data is not required. Images are formed by directly shading each sample and projecting it onto the picture plane. Surface shading calculations are performed at every voxel with local gradient vectors serving as surface normals. In a separate step, surface classification operators are applied to obtain a partial opacity for every voxel. Operators that detect isovalue contour surfaces and region boundary surfaces are presented. Independence of shading and classification calculations insures an undistorted visualization of 3-D shape. Non-binary classification operators insure that small or poorly defined features are not lost. The resulting colors and opacities are composited from back to front along viewing rays to form an image. The technique is simple and fast, yet displays surfaces exhibiting smooth silhouettes and few other aliasing artifacts. The use of selective blurring and super-sampling to further improve image quality is also described. Examples from two applications are given: molecular graphics and medical imaging.

50288 **(AD-A—193673/1/XAB) Parallel real-time expert systems. Final report, 11 November 1986-30 April 1988.** Chandrasekaran, B.; Schwan, K. (Ohio State Univ., Columbus (USA)). 20 Feb 1988. 5p. NTIS, PC A02/MF A01.

This report summarizes work done under a grant issued through the University Research Instrumentation Program. The grant was issued to support the purchase of parallel-processing equipment to conduct experimental research in high-speed real-time decision making by parallelism. The facilities were used to understand the software requirements of real-time systems, such as complex robotics systems.

50289 **(AD-A—193681/4/XAB) Programming n-cubes with a graphical parallel programming environment versus an extended sequential language. Technical report.** Gates, K.; Socha, D. (Washington Univ., Seattle (USA). Dept. of Computer Science). Nov 1986. 12p. (TR—86-12-02). NTIS, PC A03/MF A01.

The authors compare the writing and execution of programs written in Cosmic Cube C with programs written in the graphical parallel programming environment and language Poker. The example programs, an implementation of a Cholesky algorithm for a banded matrix, were written in both languages and compiled into object codes that ran on the Cosmic Cube. However the program written in Poker is shorter, faster and easier to write, easier to debug, and portable without changes to other parallel computer architectures. The Poker program was slower than the program written directly in Cosmic Cube C; however, the experiments provided insights into changes that make Poker programs nearly as fast.

50290 **(AD-A—193912/3/XAB) Nonplanar switchable arrays.** Aravena, J.L.; Porter, W.A. (Louisiana State Univ., Baton Rouge (USA)). 1988. 23p. NTIS, PC A03/MF A01.

Pub. in Circuits Systems Signal Process, Vol. 7, No. 2, 213-234(1988).

On-line signal-processing and automatic-control applications give rise to numerous examples of computationally intense algorithms. Architectures that are algorithmically specialized and provide massive parallelism are necessary to cope with such computational requirements. Systolic arrays, which feature parallelism, local communications, and VLSI compatibility appear to match up well with these computational requirements. This paper summarizes recent research on a general class of nonplanar systolic arrays. These arrays feature closed-loop data flow. The arrays may be switched dynamically to facilitate I/O simplicity and to accommodate iterative calculations without intermediate I/O interdiction. The closed-loop data flows also facilitate restructuring of the array to accommodate specific algorithmic requirements. The potential for multiuser, multialgorithm operation is also enhanced. Matrix operations are used as examples in the development. Algorithms as diversified as the Riccati equation, LU factorization, the Faddeev algorithm, FFT calculation, and controllabilty Grammians can be implemented on the nonplanar architectures.

50291 (CAPPA—8803, pp 26) **The user role in defining requirements and evaluating alternatives.** MacNaughton, J. (SHL Systemhouse, Inc., Canada). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

The author presented a methodology for selecting a computerized petroleum/gas production accounting system. It is divided into defining requirements, and evaluating alternatives. These sections are again divided to a step by step evaluation. User involvement in the selection process is emphasized. 5 figs., 1 tab.

50292 (CAPPA—8803, pp 14) **Integration of systems.** Bargman, J.F. 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

This paper defines the benefits of integrated systems with respect to production accounting. To achieve this end, the paper discusses the two approaches in integration of systems, data integration and systems integration and then highlights the benefits that can be obtained. In concluison, to be successful in integrating systems, practical systems plans are required. 6 figs.

50293 (CAPPA—8803, pp 25) **Coping with change in an automated accounting environment.** Reimer, W. (Shell Canada Ltd.). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

The product accounting function is in a very dynamic state for internal and external business reasons. Technology is moving forward so rapidly that coping is difficult, remaining in control almost impossible. In addition, people's workplace expectations are changing. This paper deals with the intersection of these three very dynamic orbits, that is the automated accounting function. The paper examines the underlying causes of change in each orbit and then offers some "rules-of-thumb" to help accounting and management cope with this change. 9 figs.

50294 (CAPPA—8803, pp 9) **Gas transportation management: a NOVA system overview.** Halliwell, K.A. (NOVA Corp. of Alberta). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

NOVA Coporation of Alberta's Gas Transmission Division is presently involved in a number of systems development projects intended to improve the ability to monitor, control and account for the business of gas transportation. These systems will improve the accuracy of information, reduce time delays in availability of information, and improve computing efficiencies. Three major developments are discussed: the new distributed Supervisory Control and Data Acquisition (SCADA) system installed in 1987, the measurement modernization program currently underway to replace all custody transfer chart metering locations with electronic flow measurement, the development of an integrated transportation management system for realtime and custody transportation balancing. The target of this development is an elecronically supported system which incorporates SCADA, electronic flow measurement, contracts, nominations, customer allocations, and information dissemination. 4 figs.

50295 (CAPPA—8803, pp 17) **Automated field data collection.** Reed, G.A. (Amoco Canada Petroleum Co. Ltd.). 1988. Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CE—01773; CONF-8803137—).

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

This presentation discusses Amoco Canada's progress and experiences in the application of computing and telecommunications technology to the process of collecting production data. Advances in electronics technology have made the process technically feasible. However, in the oil and gas industry, progress has been slowed by the severe service conditions, the remoteness of the facilities and rapid changes in field developments. Progress has not been as noticeable as in the banking services area for example. The presentation discusses aspects effecting the design, implementation and ongoing operation of automation systems and provides some advice and also some precautions that should be considered.

50296 (CAPPA—8803) **Production accounting software: the key to productivity control & cashflow.** (Canadian Association of Petroleum Production Accounting, Calgary, Alberta; Dome Petroleum Ltd. (Canada)). 1988. 208p. (CE—01773; CONF-8803137—). Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN.

From Production accounting software conference; Calgary, Canada (1 Mar 1988).

This conference covers the collection, processing and dissemination of production data by industry and government. It also covers industry's reaction to changes in the Natural Gas Royalty regime, effective January 1, 1988. Separate abstracts were prepared for fourteen papers from the conference.

50297 (CONF-880974—1) **Application of the thin cavity method to shield calculations in electroplating.** Gray, L.J.; Giles, G.E. (Oak Ridge National Lab., TN (USA); Martin Marietta Energy Systems, Inc., Oak Ridge, TN (USA)). Apr 1988. Contract AC05-84OR21400. 11p. (BSC—88/23). NTIS, PC A03. Order Number DE88011382/JAW.

From BEM-10: 10th boundary element meeting; Southampton, UK (6 Sep 1988).

In a computational model of an electroplating tank, a thin shield can be conveniently approximated as a zero-thickness 'crack.' A newly developed boundary element method for treating cracks is especially advantageous for treating complicated three-dimensional geometries, such as plating cell configurations. In particular, nonsmooth shields, i.e., wherein a normal direction is not everywhere defined on the surface, can occur in practical plating applications. This paper will describe a technique for handling non-smooth shields, and calculations for an actual plating configuration will be presented. 11 refs., 9 figs., 3 tabs.

50298 (CONF-8706328—Absts.) **Computer experimentation in non linear analysis: Conference technical report.** Chicone, C. (Missouri Univ., Columbia (USA). Dept. of Mathematics). 1987. Contract FG02-87ER25040. 16p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013754/JAW.

From Computer experimentation in non linear analysis conference; Columbia, MO, USA (4 Jun 1987).

The purpose of the conference was to provide a forum for the exchange of scientific reports on some recent results in mathematics where computer experimentation or computer implementation plays a central role. In the appended material we have listed the public features of the conference: the schedule of events, the abstracts of the lectures and a list of participants. The main themes discussed were information compactification, chaos, computer algebra and computer graphics.

50299 (DOE/ER/25007—T2) **Local and Q-superlinear convergence of a class of collinear scaling algorithms that extends quasi-Newton methods with Broyden's bounded-{phi} class of updates.** Ariyawansa, K.A.; Lau, D.T.M. (Washington State Univ., Pullman (USA). Dept. of Pure and Applied Mathematics). [1988]. Contract FG06-85ER25007. 14p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015515/JAW.

A derivation of collinear scaling algorithms for unconstrained minimization was presented. The local conic approximants to the objective function underlying these algorithms are forced to interpolate the value and gradient of the objective function at the two most recent iterates. The class of algorithms derived therein has a free parameter sequence {l←brace}b/sub k/{r←brace} and for a fixed choice of {l←brace}b/sub k/{r←brace} it contains collinear scaling algorithms that may be treated as extensions of quasi-

Newton methods with Broyden family of updates. In this paper, under standard assumptions, it is shown that if b/sub k/ is set equal to the gradient of the objective function for all k and if {l←brace}chemical bond! {minus} θ/sub k/chemical bond{r←brace} (where θ/sub k/ is the parameter in the Broyden family) is uniformly bounded, then these collinear scaling algorithms related to the Broyden family are locally and q-superlinearly convergent. 13 refs.

50300 (DOE/ER/25009—587) PC-CUBE, a personal computer based hypercube. Ho, A.; Fox, G.; Walker, D.; Snyder, S.; Chang, D.; Chen, S.; Breaden, M.; Cole, T. (California Inst. of Tech., Pasadena (USA); Jet Propulsion Lab., Pasadena, CA (USA)). 1988. Contract FG03-85ER25009. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015008/JAW.

PC-CUBE is an ensemble of IBM PCs or close compatibles connected in the hypercube topology with ordinary computer cables. Communication occurs at the rate of 115.2 K-baud via the RS-232 serial links. Available for PC-CUBE is the Crystalline Operating System III (CrOS III), Mercury Operating System, CUBIX and PLOTIX which are parallel I/O and graphics libraries. A CrOS performance monitor was developed to facilitate the measurement of communication and computation time of a program and their effects on performance. Also available are CXLISP, a parallel version of the XLISP interpreter; GRAFIX, some graphics routines for the EGA and CGA; and a general execution profiler for determining execution time spent by program subroutines. PC-CUBE provides a programming environment similar to all hypercube systems running CrOS III, Mercury and Cubix. In addition, every node (personal computer) has its own graphics display monitor and storage devices. These allow data to be displayed or stored at every processor, which has much instructional value and enables easier debugging of applications. Some application programs which are taken from the book Solving Problems on Concurrent Processors [Fox 88] were implemented with graphics enhancement on PC-CUBE. The applications range from solving the Mandelbrot set, Laplace equation, wave equation, long range force interaction, to WaTor, an ecological simulation.

50301 (DOE/ER/25009—591) A mathematical analysis of the scattered decomposition. Salmon, J. (California Inst. of Tech., Pasadena (USA)). 1988. Contract FG03-85ER25009. 2p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015015/JAW.

A theoretical basis for the scattered decomposition is worked out in some detail. The basic result has been part of the {open←quotes}folklore{close←quotes} for some time, but has never been proved. The load imbalance expected from a scattered decomposition of a set of computational tasks is proportional to the number of tasks assigned to each processor, the mean time per task and root mean square deviation timer per task. The constant of proportionality is a very slowly increasing function of the number of processors. 4 refs.

50302 (DOE/ER/25009—593) An O(NlogN) hypercube N-body integrator. Warren, M.; Salmon, J. (California Inst. of Tech., Pasadena (USA)). [1988]. Contract FG03-85ER25009. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015016/JAW.

The gravitational N-body algorithm of Barnes and Hut has been successfully implemented on a hypercube concurrent processor. The novel approach of their sequential algorithm has demonstrated itself to be well suited to hypercube architectures. The sequential code achieves O(NlogN) speed by recursively dividing space into subcells, thereby creating a hierarchical grouping of particles. Computing interactions between these groups dramatically reduces the amount of communication between processors, as well as the number of force calculations. Parallelism is achieved through an irregular spatial grid decomposition. Since the decomposition topology is not simple, a general loosely synchronous communication routine has been developed. Operations are simplified if the conventional grey code decomposition is modified so that the bits are taken alternately from each cartesian dimension. A speedup of 180 has been achieved for a 500,000 particle two-dimensional calculation on 256 processors. A speedup of 65 has been obtained for a 64,000 particle three-dimensional calculation on 256 processors. 12 refs., 5 figs.

50303 (DOE/ER/25026—23) Massive parallelism across the method in ODEs. Gear, C.W. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Jul 1988. Contract FG02-87ER25026. 11p. (CONF-8806187—1; UILU-ENG—88-1747; UIUCDCS-R—88-1442). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013932/JAW.

From Numerical solution of IVPs for ODEs conference; Toronto, Canada (20 Jun 1988).

Large systems of unstructured ODEs, such as those arising in VLSI device simulation often cannot be effectively solved by parallelism across space, especially on SIMD or vector machines, because of the lack of similarity of the equations from subsystem to subsystem. This report examines a method that has the potential to permit the use of vector or SIMD architectures in parallelism across time (also called parallelism across the method). The method is related to modified Picard, or waveform, methods in that it is iterative, starting from an initial discrete value approximation that would normally be chosen as a constant equal to the known initial value. As in waveform methods, this method should be applied over a series of windows, but this report does not address important implementation issues such as starting, error control, and window selection. Rather, it introduces the class of methods and demonstrates that some members exist and have useful properties such as convergence of the iteration to a zero-stable and stiffly-stable multistep method. This is an interim report on the development of the method. 2 refs., 1 fig.

50304 (DOE/OR/00033—T412) Iterative solution of a nonlinear system arising in phase change problems. Williams, M.A. (Lehigh Univ., Bethlehem, PA (USA)). 1987. Contract AC05-76OR00033. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88015645/JAW.

We consider several iterative methods for solving the nonlinear system arising from an enthalpy formulation of a phase change problem. We present the formulation of the problem. Implicit discretization of the governing equations results in a mildly nonlinear system at each time step. We discuss solving this system using Jacobi, Gauss-Seidel, and SOR iterations and a new modified preconditioned conjugate gradient (MPCG) algorithm. The new MPCG algorithm and its properties are discussed in detail. Numerical results are presented comparing the performance of the SOR algorithm and the MPCG algorithm with 1-step SSOR preconditioning. The MPCG algorithm exhibits a superlinear rate of convergence. The SOR algorithm exhibits a linear rate of convergence. Thus, the MPCG algorithm requires fewer iterations to converge than the SOR algorithm. However in most cases, the SOR algorithm requires less total computation time than the MPCG algorithm. Hence, the SOR algorithm appears to be more appropriate for the class of problems considered. 27 refs., 11 figs.

50305 (EGG-M—36987) Sound software engineering principles: How to follow them when budgets, schedules, or managers don't permit. Van Siclen, V.S. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-8806108—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015124/JAW.

From Society of Women Engineers' national convention; San Juan, Puerto Rico (22 Jun 1988).

In the real world of software development it is often impossible to follow a full-fledged development program based on sound software engineering principles, due to budget, schedule, or even management constraints. Yet how can you you provide a high quality product with sufficient documentation without following such a program? This paper describes some of the problems encountered when software engineering principles are not followed, then briefly reviews those principles, and finally suggests some very effective techniques to use when you cannot follow a formal development plan. 4 refs.

50306 **(EGG-M—88251) Unexpected effects of computer presented procedures.** Blackman, H.S.; Nelson, W.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 3p. (CONF-880633—8). NTIS, PC A02. Order Number DE88015182/JAW.

From 4. international conference on human factors and power plants; Monterey, CA, USA (5 Jun 1988).

Results from experiments conducted at the Idaho National Engineering Laboratory will be presented regarding the computer presentation of procedural information. The results come from the experimental evaluation of an expert system which presented procedural instructions to be performed by a nuclear power plant operator. Lessons learned and implications from the study will be discussed as well as design issues that should be considered to avoid some of the pitfalls in computer presented or selected procedures. 1 ref., 1 fig.

50307 **(EPRI-NP—5645M) Small artificial reasoning toolkit: An expert system development toolkit: AI overview.** Cain, D. (Electric Power Research Inst., Palo Alto, CA (USA)). Jul 1988. 63p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88015249/JAW.

In the several years since EPRI has been investigating artificial intelligence technology for electric power applications, a number of expert systems methods have shown themselves to be intrinsically useful for practical applications. The SMall Artificial Reasoning Toolkit (SMART) has been developed especially for electric utility personnel, providing, in a compact form, this essential collection of software capabilities. SMART is particularly well-suited for those who wish to master the fundamentals of knowledge engineering. This is a necessary step in moving from exploratory investigation of expert systems concepts towards actual expert system implementation and development to useful ends. The present version of SMART features an open software architecture and collection of expert system tools giving the utility developer, serving as knowledge engineer, explicit control over knowledge base structure and reasoning processes. The package is designed to support extension, elaboration and customization to accommodate a variety of utility expert systems, consistent with the memory and processing limitations of the IBM-PC (or compatible) class of machines. Documentation includes a description of the various tools and functions, example expert systems, a series of tutorials, and a source code listing. 5 figs. 4 tabs.

50308 (INIS-BR—1147-Vol.1, pp 49-59) **MOCUSN: a computer program for determining prime implicants.** Vieira Neto, A.S. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88703247/JAW. (CONF-880440—).

From 2. general congress on nuclear energy; Rio de Janeiro, Brazil (23 Apr 1988).

In this paper a new MOCUS algorithm for finding the prime implicants of non-coherent systems fault trees is described and compared with WAMCUT algorithm.

50309 **(LA—11392-MS) Supercomputing: An indispensable component of applied research.** Miller, W.F. (Los Alamos National Lab., NM (USA). Center for National Security Studies). Jul 1988. Contract W-7405-ENG-36. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88015363/JAW.

Computational science's part in scientific inquiry is discussed as well as developments in several aspects of scientific supercomputing. Also discussed are supercomputer applications and challenges in the future.

50310 **(LA-UR—88-1590) Mean estimation in highly skewed samples.** Pederson, S.; Beckman, R.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 14p. (CONF-880872—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88010929/JAW.

From Joint statistical meetings; New Orleans, LA, USA (22 Aug 1988).

When data arise from an asymmetric population, and the center of such a population is of interest, many techniques are available to estimate this center. Most involve either developing an estimator robust to the asymmetry, or transforming the data to create a more symmetric distribution. In these cases the true mean of the underlying population is not preserved; rather, quantities such as the median are estimated. There are situations, however, in which the mean is really the quantity of interest. For example, in neutron transport problems the energies of individual particles are measured. Primary interest may be in total energy: this is merely a rescaling of mean energy per particle. This report details some efforts to develop mean estimation techniques in large samples of highly skewed data. 3 refs., 2 figs.

50311 **(LA-UR—88-1836) Parallel processing a real code: A case history.** Mandell, D.A.; Trease, H.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 21p. (CONF-8805169—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014456/JAW.

From Workshop on instrumentation for future parallel systems; Santa Fe, NM, USA (19 May 1988).

A three-dimensional, time-dependent Free-Lagrange hydrodynamics code has been multitasked and autotasked on a Cray X-MP/416. The multitasking was done by using the Los Alamos Multitasking Control Library, which is a superset of the Cray multitasking library. Autotasking is done by using constructs which are only comment cards if the source code is not run through a preprocessor. The 3-D algorithm has presented a number of problems that simpler algorithms, such as 1-D hydrodynamics, did not exhibit. Problems in converting the serial code, originally written for a Cray 1, to a multitasking code are discussed, Autotasking of a rewritten version of the code is discussed. Timing results for subroutines and hot spots in the serial code are presented and suggestions for additional tools and debugging aids are given. Theoretical speedup results obtained from Amdahl's law and actual speedup results obtained on a dedicated machine are presented. Suggestions for designing large parallel codes are given. 8 refs., 13 figs.

50312 **(LA-UR—88-2429) Vortex lattices in theory and practice.** Capmbell, Laurence J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 11p. (CONF-8804169—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014393/JAW.

From Workshop on mathematical aspects of vortex dynamics; Washington, DC, USA (25 Apr 1988).

The formal simplicity of ideal point vortex systems in two dimensions has long attracted interest in both their exact solutions and in their capacity to simulate physical processes. Attention here is focused on infinite, two-fold periodic vortex arrays, including an expression for the energy density of an arbitrary vortex lattice (i.e., an arbitrary number of vortices with arbitrary strengths in a unit cell parallelogram of arbitrary shape). For the case of two vortices per unit cell, the morphology of stable lattices can be described completely. A non-trivial physical realization of such lattices is a rotating mixture of ^{3}He and ^{4}He at temperatures so low that both isotopic components are superfluid. The structure of the expected lattices is quite different from the usual triangular structure. Magnetic flux lines in high-temperature superconductors show a one-parameter family of degenerate ground state of the lattice due to the anisotropy of the vortex--vortex interaction. A final topic, closely related to Josephson-junction arrays, is the case of vortices confined to a grid. That is, the vortices interact pair-wise in the usual manner but are constrained to occupy only locations on an independent periodic grid. By using vortex relaxation methods in the continuum and then imposing the grid it is possible to find low-lying states extremely rapidly compared to previous Monte Carlo calculations. 11 refs., 8 figs.

50313 **(ORNL/DSRD/TM—13) Personal computer security software tools.** Boling, M.E. (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015320/JAW.

Several data security packages for the personal computer (PC) were evaluated. Particular attention was paid to encryption features and control of access to data on the PC. However, all features were assessed. It was concluded that most of the packages would be useful in an environment that required limited security,

but none would suffice in an environment that required high security to cope with a threat from sophisticated intruders. None of the products are suitable for use on a local area network (LAN) server because of faulty features or lack of multiuser capability. All of these products will likely be improved and judged more complete in the future. The features matrix developed from these products provides a good overview of some typical features offered by such data security software. In the software reviewed, the user interface often plays an integral role in the implementation of access control. Other products on the market offer interface features that duplicate or overlap with these. This conflict will result in complex choices for users when installing and using such software combinations. This is an argument in favor of data security software that is modular and operates in the background without interfering with other software needs and choices. Two basic data security issues are identified and discussed. These issues concern the ability to encrypt all traffic to be transmitted beyond the work station over a network or by modem, and the ability to control access to data and software on the work station that has not been encrypted. Each product evaluated is assessed on the basis of these features as fundamental requirements. 1 fig., 2 tabs.

50314 **(ORNL/TM—10679) A computer vision system for a hypercube concurrent ensemble.** Jones, J.P.; Mann, R.C.; Simpson, E.M. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 65p. (CESAR—88/04). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015356/JAW.

A system of image processing and analysis utilities for a general-purpose hypercube topology concurrent multiprocessor system is described. The purpose of the system is to provide an efficient development and run-time environment for theoretical and experimental inquiry into computational vision for mobile and manipulative robots. An additional objective is to provide an environment with rich support for the development of concurrent computer vision algorithms. A number of principles for programming concurrent systems are embodied in the implementation of this system. In particular, all significant computation is performed by the hypercube proper, reserving the host processor exclusively for input/output functions. One consequence of this principle is that applications are developed by viewing the concurrent multiprocessor as a single computer with a special internal structure, rather than as a number of independent machines. Applications derive from a single source, rather than many, reducing development time without sacrificing run-time efficiency. This document serves as an introduction to the image processing and analysis system, its principles of operation, and as a reference manual for its use. 21 refs., 3 figs.

50315 **(PB—88-205174/XAB) Geometric arithmetic parallel processors (construction of a cellular automation using gapp). Final report.** (Aix-Marseille-1 Univ., 13 - Marseille (France)). Dec 1987. 38p. (In French). NTIS, PC E04/MF E04.

The object of the research contract was to construct a parallel computer dedicated to network statistical simulations and to test it with a known gas model. The authors built a computer prototype dubbed OUPPI 1 (Computer with Integrated Parallel Processors), using two NCR Geometric Arithmetic Parallel Processors (GAPP). A special set of easily-linked modular software programs called GALIS (GAPP Linkable System) were also written for the test programs and are described. OUPPI 1 instructions are contained in a program memory and are relayed to the GAPPs by a microsequencer at a maximum rate of 10 MHz. A classic host computer is used to program the microinstructions into the program memory prior to calculations; the host program is also used to write initial data into a data memory, which later reads calculation results and provides a graphic representation of them. Several network statistical simulations were successfully programmed and tested: gas on a square network, gas on a triangular network, and an Ising model. The small size of the networks used in these simulations (48 x 48) cannot provide results of any interest to physicists. The material and software modifications necessary to simulate larger networks are discussed in the last chapter.

50316 **(PB—88-215520/XAB) Parallel-processing benchmarks.** Lyon, G.E. (National Bureau of Standards (ICST), Washington, DC (USA). Advanced Systems Div.). Jun 1987. 36p. (NBSIR—87/3580). NTIS, PC A03/MF A01.

See also PB—87-137196.

This is a summary of preliminary work and experiences at NBS on benchmarks for parallel machines. Discussion covers the several roles that benchmarks play, ideal and realistic settings, and quick reviews of several types of benchmark sets. Several recommendations can be forwarded, given the rudimentary nature of parallel-processor characterization: (1) That the performance metrics be embedded in more comprehensive frameworks that can be appraised and modified as needed; (2) That one universal framework is beyond reach, since distinct clusters of use are emerging with separate emphases; (3) That large application benchmarks are most successful when they run well on a machine–and thus demonstrate success for a narrow class; (4) That to programmers, the value of smaller metrics (fragments of code) is more diagnostic and preventive than predictive. Small metric sets should encourage the parametric study of architectures and applications, and thereby promote both economical hardware enhancement and suitable program design.

50317 **(SAND—87-0543) Hawkeye: A real-time task debugger for the SANDAC V.** Piorkowski, K.M. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1987. Contract AC04-76DP00789. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88002823/JAW.

This report describes the real-time task debugger for the Hawk hard-real-time operating system executing on the SANDAC V embedded, multiprocessor computer. This debugger, named Hawkeye, provides the standard gateway console interface to Hawk. 18 figs., 1 tab.

50318 **(SAND—88-0371C) A linear programming approach to maximum entropy signal restoration.** Mastin, G.A.; Ghiglia, D.C. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 8p. (CONF-880887—3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013021/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

In future computing environments where computer resources are abundant, a linear programming (LP) approach to maximum entropy signal/image restoration could have advantages over traditional techniques. A revised simplex LP algorithm with inequality constraints is presented. Dantzig's bounded-variable method is used to express the maximum entropy restoration problem as a LP problem. This is done by approximating the nonlinear objective function with piecewise linear segments, then bounding the variables as a function of the number of segments used. Linear inequality constraints may be used to assure a basic feasible solution. Experimental results with 512-point signals are presented. These include restorations of noisy signals. Problems with as many as 513 equations and 6144 unknowns are demonstrated. The complexity of the LP restoration approach is briefly addressed. 14 refs., 4 figs.

50319 **(SAND—88-1115) MIDAS: Multiple Instrument Data Acquisition Software user guide.** Mikkelson, K.A. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014703/JAW.

MIDAS (Multiple Instrument Data Acquisition Software) is a software package which supports data acquisition and analysis. It is similar in function to AQD but is written in SPS Basic, is simpler to operate, and provides an alternative approach when AQD is not appropriate. MIDAS can support a wide variety of recorders, and can be used in either stand-alone or networked systems. Also, adding new recording instruments to the package can be accomplished with minimal effort.

50320 (SAND—88-1739) LISTND: network server daemon for UNIX systems. Duggan, D. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 24p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015416/JAW.

The program LISTND was designed to improve the environment that our design engineers need to design VLSI circuits. It came about because the workstations that we were using were limited in address space and speed. The "mainframe" computer that we were using at the time was faster and ran a circuit simulation code that was tailored for it. The circuit simulator on the workstations also had problems with certain types of circuits that the mainframe version could analyze correctly. The first version of the interface used 9600 baud terminal lines as the communications medium. This proved to be somewhat slow, but was still necessary for some circuits due to the incorrect answers the workstation simulator gave. This version was highly specific to the application. It soon became clear that a better approach to go was to have the interface use the ethernet local area network that was being installed. However, the network software on the workstations was not working reliably for almost 2 years. It was also decided that the interface, if it was more general, could be used for other applications as well. Thus, the first real version of LISTND was born. The design was mostly top-down with some critical portions being designed and prototyped several times. This was done mostly due to my unfamiliarity with the networking primitives of UNIX. It was done as a characterization of these system calls as to what was needed for certain things to happen. The documentation of these calls and of their use was almost useless for someone trying to learn them. It seemed that all the documentation was written as a reference for the person that already had a good knowledge of the workings of these system calls. I would like to thank Glenn Machin for his assistance and input during the design and testing phases of this project.

50321 (SAND—88-1875C) Factoring very large numbers using a massively parallel computer. Holdridge, D.B.; Davis, J.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-880785—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014247/JAW.

From Computational number theory conference; Brunswick, ME, USA (10 Jul 1988).

This paper discusses the Quadratic Sieve algorithms of factoring large numbers or parallel processors. 9 refs.

50322 (SLAC-PUB—4665) Bootstrap confidence intervals in a complex situation: A sequential paired clinical trial. Morton, S.C. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jun 1988. Contract AC03-76SF00515. 25p. (CONF-880872—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015338/JAW.

From Joint statistical meetings; New Orleans, LA, USA (22 Aug 1988).

This paper considers the problem of determining a confidence interval for the difference between two treatments in a simplified sequential paired clinical trial, which is analogous to setting an interval for the drift of a random walk subject to a parabolic stopping boundary. Three bootstrap methods of construction are applied: Efron's accelerated bias-covered, the DiCiccio-Romano, and the bootstrap-t. The results are compared with a theoretical approximate interval due to Siegmund. Difficulties inherent in the use of these bootstrap methods in a complex situations are illustrated. The DiCiccio-Romano method is shown to be the easiest to apply and to work well. 13 refs.

50323 (SOL—88-8) Parallel processors for planning under uncertainty. Dantzig, G.B.; Glynn, P. W. (Stanford Univ., CA (USA). Systems Optimization Lab.). Jun 1988. Contract FG03-87ER25028. 19p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88016184/JAW.

In this paper we describe joint research under way by Mordecai Avriel, Robert Entriken, and the authors. Our goal is to demonstrate, for an important class of multistage stochastic models, that a variety of techniques for solving large-scale linear programs can be effectively mixed to attack this fundamental problem. The ideas involve nested primal and dual decomposition, combined with Monte Carol simulation, high speed importance sampling, and quadrature methods for numerical integration, together with the use parallel processors. 35 refs.

50324 (SOL—88-13) The Frobenius metric in image registration: Technical report. Zikan, K.; Silberberg, T.M. (Stanford Univ., CA (USA). Dept. of Operations Research). Jul 1988. Contract FG03-87ER25028. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88016685/JAW.

Image registration involves estimating how one set of n-dimensional points is rotated, scaled, and translated into a second set of n-dimensional points. In practice, n is usually 2 or 3. We consider a Frobenius norm approach in which a point-to-point matching between the sets (if they are of the same cardinalities) and the corresponding transformation are determined. Two strategies are investigated: the pruned tree approach and the parametric linear programming approach. Various versions of tree pruning approach have been investigated by other authors, whereas the parametric programming method is believed to be new. It addresses several inherent problems of the tree pruning method. Both approaches determine the rotation after scale and translation are removed. In the pruned tree approach, possible matchings of two- or three- dimensional points are partially enumerated using a tree search; the tree is pruned according to criteria based on the metric. The parametric approach solves an assignment problem for a number of candidate rotations. Each evaluation results in the point-to-point correspondence; the optimal matching corresponds to the rotation that minimizes the associated cost function. This approach, which has $O(k^3)$ worst case asymptotic complexity, is more tolerant of noise than the pruned tree approach and can be readily extended to the cases where the sets to be registered are of different cardinalities. 27 refs., 8 figs., 5 tabs.

50325 (UCID—21457) Actuator/sensor modeling for integrated structural control. Young, K.D. (Lawrence Livermore National Lab., CA (USA)). 31 May 1988. Contract W-7405-ENG-48. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88014698/JAW.

This report summarizes work performed at LLNL on actuator/sensor modeling for integrated structural control. There are four sections and three attachments in the report: Section 1 illustrates the need to integrate actuator/sensor models with the structural dynamics model in structural control design. Section 2 introduces a generic SBL model, called the Pajaro Problem, developed at LLNL for examining the model integration issues. Section 3 outlines the procedures for integrating the actuator and sensor models with the structural model. Section 4 describes a model reduction procedure which produces directly a reduced order structural controller, by passing the reduction of the integrated actuator-structure dynamic model. Through the model integration exercise conducted in this work, a number of conclusions can be made. We have demonstrated that an integrated modeling approach is essential to structural control. With the Pajaro Problem, we have developed the dynamic models for the support structure, the slewing actuators, the mirror actuators, and a sensor model to characterize the optical ray trace. These models are integrated to form a dynamic model with actuator commands as the inputs and variables characterizing the exiting rays of the optical train as outputs. We have also demonstrated that the use of a high level matrix-oriented language facilitated the systematic handlings of matrix expressions and linear state space equations. The dynamic analysis and control design work reported herein however required additional programming in FORTRAN. The LLNL EAGLES/Controls or other similar commercial computer-aided control system design packages which allow similar high level matrix manipulations as well as performing dynamic analysis and control design would be a candidate software tool for the development of integrated structural control. 3 refs.

50326 (UCRL—98453) State-of-the-art Monte Carlo 1988. Soran, P.D. (Lawrence Livermore National Lab., CA (USA)). 28 Jun 1988. Contract W-7405-ENG-48. 13p. (CONF-880906—5). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014138/JAW.

From 7. international conference on radiation shielding; Bournemouth, UK (12 Sep 1988).

Particle transport calculations in highly dimensional and physically complex geometries, such as detector calibration, radiation shielding, space reactors, and oil-well logging, generally require Monte Carlo transport techniques. Monte Carlo particle transport can be performed on a variety of computers ranging from APOLLOs to VAXs. Some of the hardware and software developments, which now permit Monte Carlo methods to be routinely used, are reviewed in this paper. The development of inexpensive, large, fast computer memory, coupled with fast central processing units, permits Monte Carlo calculations to be performed on workstations, minicomputers, and supercomputers. The Monte Carlo renaissance is further aided by innovations in computer architecture and software development. Advances in vectorization and parallelization architecture have resulted in the development of new algorithms which have greatly reduced processing times. Finally, the renewed interest in Monte Carlo has spawned new variance reduction techniques which are being implemented in large computer codes. 45 refs.

50327 **(UCRL—98639) Numerical estimates of the rate of convergence for the vortex sheet method.** Puckett, E.G. (Lawrence Livermore National Lab., CA (USA)). 25 May 1988. Contract W-7405-ENG-48;AC03-76SF00098. 15p. (CONF-880716—7). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88013809/JAW.

From 1. national fluid dynamics congress; Cincinnati, OH, USA (24 Jul 1988).

The vortex sheet method for approximating solutions of the Prandtl equations is demonstrated numerically to the exact solution when it is used to model Blasius flow. This is a random walk method and therefore the error is a random variable. The expected value and the standard deviation of the error as a function of the computational parameters has been estimated. This allows us to estimate the dependence of the error on each parameter and hence to find the relation between the parameters which maximizes accuracy and efficiency. It has been demonstrated that the proper choice parameters leads to a reduced statistical error, thus allowing one to nearly achieve the expected rate of convergence without averaging the solution. 25 refs., 3 figs., 3 tabs.

50328 **(WHC-SA—0117) Next generation power reactor information system.** Leitz, E.E. (Westinghouse Hanford Co., Richland, WA (USA)). 1988. Contract AC06-87RL10930. 6p. (CONF-880506—23). NTIS, PC A02. Order Number DE88013668/JAW.

From Safety of next generation power reactors; Seattle, WA, USA (1 May 1988).

The next generation power reactors need to include consideration for collection and application of operating data and follow-on analysis in plant designs to enhance future use of the data during the life of the plant. This paper explains how N Reactor experience on the Hanford Site in Washington State supports the need for such a system and describes some of the elements that such a system would require. An identifying code for each significant plant component is fundamental to an information system. This unique code is used to maintain equipment history files and to cross-reference other data records to the equipment history files. The system output must be oriented to ensure that complete data on any specific component are available on demand. 3 refs., 1 tab.

50329 **(WHC-SA—0233) Task simulation in computer-based training.** Gardner, P.R. (Westinghouse Hanford Co., Richland, WA (USA)). Feb 1988. Contract AC06-87RL10930. 7p. (CONF-880293—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014018/JAW.

From Interactive instruction delivery conference; Orlando, FL, USA (24 Feb 1988).

Westinghouse Hanford Company (WHC) makes extensive use of job-task simulations in company-developed computer-based training (CBT) courseware. This courseware is different from most others because it does not simulate process control machinery or other computer programs, instead the WHC Excerises model day-to-day tasks such as physical work preparations, progress, and incident handling. These Exercises provide a higher level of motivation and enable the testing of more complex patterns of behavior than those typically measured by multiple-choice and short questions. Examples from the WHC Radiation Safety and Crane Safety courses will be used as illustrations. 3 refs.

50330 **(Y/DW—771) Computer integrated manufacturing implementation at the Oak Ridge Y-12 Plant: The sixth year of a ten-year plan.** Davenport, C.M.; Bowers, G.L. (Oak Ridge Y-12 Plant, TN (USA)). 7 Oct 1987. Contract AC05-84OS21400. 14p. (CONF-880902—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88005203/JAW.

From Petroleum and chemical industry conference; Dallas, TX, USA (12 Sep 1988).

The strategic and operational plans for the computer integrated manufacturing (CIM) program in the Y-12 Plant are providing for the evolution of the plant's CIM infrastructure from today's environment to the integrated, highly flexible, and more responsive manufacturing systems planned for the 1990s. The program is committed to meeting the CIM directives established by the US Department of Energy and providing the means by which operations can improve the manufacturing performance of the Y-12 Plant. The plant's CIM program charter is a commitment to coordinating efforts to implement and integrate CIM technologies to improve manufacturing performance and thus significantly enhance the plant's ability to meet current and future manufacturing objectives. To achieve these objectives, CIM technologies are being applied to automate manufacturing processes and informations systems.

50331 **Menu-driven menu editor and associated menu system.** Preckshot, G.G.; Butner, D.N. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Review of Scientific Instruments;* **59**: No. 8, 1777-1779(Aug 1988).

A menu-style user interface has been developed at Lawrence Livermore National Laboratory (LLNL) for distributed control, data acquisition, and data processing. A graphical menu editor, which is itself the first application of the menu system, is used to construct or modify menu hierarchies. Unlike many menu systems, no code need be written to demonstrate a set of menus because there are no subroutine calls to make menus; developers need only write the code that performs the actions indicated by user menu picks. In addition to this rapid prototyping feature, the menu system is integrated with operating system asynchronous traps (in Unix, signals, and selects) so that it supports real-time user interfaces for control in a distributed computer system. UFrsi1

50332 **LOCUS database system.** Murphy, J.A.; Wieland, R.M. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543-0451). *Review of Scientific Instruments;* **59**: No. 8, 1780-1782(Aug 1988).

LOCUS is a database system for creating, manipulating, and interactively investigating databases. LOCUS was written in response to the need to study the data from the experimental devices at the Princeton Plasma Physics Laboratory and is now also used extensively at other fusion laboratories. An example of its use is the determination of scaling laws for tokamak plasmas. To do this, LOCUS allows the user to enter and modify data, define subsidiary variables as arbitrary functions of original data, plot and fit such variables, and perform multiple linear regression analysis. Through a flexible interactive interface the program is easy to learn and largely self-documenting. There are two implementations of LOCUS: one that manipulates data in VAX/VMS ISAM files and another that manipulates data in the commercial relational database management system INGRES.

50333 **ATF data management.** Kannan, K.L.; Baylor, L.R. (Oak Ridge National Laboratory, P.O. Box Y, Oak Ridge, Tennessee 37831). *Review of Scientific Instruments;* **59**: No. 8, 1783-1785(Aug 1988).

Data management for the Advanced Toroidal Facility (ATF), a stellarator located at Oak Ridge National Laboratory, is provided by DMG, a locally developed, VAX-based software system. DMG is a data storage and retrieval software system that provides the user interface to ATF raw and analyzed data. Data are described in terms of data models and data types and are organized as signals into files, which are internally documented. The

system was designed with user accessibility, software maintainability, and extensibility as primary goals. Extensibility features include compatibility with ATF as it moves from pulsed to steady-state operation and capability for use of the DMG system with experiments other than ATF. DMG is implemented as a run-time library of routines available as a shareable image. General-purpose and specialized data acquisition and analysis applications have been developed using the DMG system. This article describes the DMG system and the interfaces to it.

50334 **Integrated, multivendor distributed data-acquisition system.** Butner, D.N.; Drlik, M.; Meyer, W.H.; Moller, J.M.; Preckshot, G.G. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Review of Scientific Instruments;* **59**: No. 8, 1786-1788(Aug 1988).

A distributed data-acquisition system that used various computer hardware and software is being developed to support magnetic fusion experiments at Lawrence Livermore National Laboratory (LLNL). The experimental sequence of operations is controlled by a supervisory program, which coordinates software running on Digital Equipment Corporation (DEC) VAX computers, Hewlett—Packard (HP) UNIX-based workstations, and HP b-smcapsASIc-smcaps desktop computers. An interprocess communication system (IPCS) allows programs to communicate with one another in a standard manner regardless of program location in the network or of operating system and hardware differences. We discuss the design and implementation of this data-acquisition system with particular emphasis on the coordination model and the IPCS.

50335 **Scientific and statistical data management research at LBL.** Olken, F.; Rotem, D.; Shoshani, A.; Wong, H.K.T. (Computer Science Research Dept., Lawrence Berkeley Lab., Berkeley, CA (US)). pp 1-20 of Proceedings of the third international workshop on statistical and scientific database management. Cubitt, R.; Cooper, B.; Ozsoyoglu, G. Los Alamitos, CA; IEEE Computer Society (1986). (CONF-860751—).

From 3. international workshop on statistical and scientific database management; Luxembourg, Luxembourg (22 Jul 1986).

This paper is a review of scientific and statistical data management research at LBL in recent years in the areas of: logical modeling and user interfaces, database operators, and physical organization and access methods. In the area of logical modeling and user interfaces the authors discuss: SUBJECT, a system for organizing multi-dimensional data, GUIDE, a graphical query system, and logical modeling of temporal data. In database operations they discuss sampling from relational databases, and transposition of compressed data. In the area of physical DB organization and access methods they discuss: header data compression, rearrangement of data arrays to enhance data compression, batched interpolation search, bit transposed file organization, techniques for controlling overflow from multi-dimensional data structures (e.g. grid files), and data structures for temporal data.

9903 Information Handling

REFER ALSO TO CITATION(S) 48099, 48198, 48702, 48787, 49234, 50275, 50276, 50290

50336 **(DOE/DP/20133—T1) Develop an automated data base management system (DBMS): Report on DBMS software and user's guide: Final Report, Task 2.** (Arinc Research Corp., Annapolis, MD (USA)). Aug 1987. Contract AC01-85DP20133. 55p. (ARINC—3067-01-01-4437). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88015996/JAW.

This final report, prepared for the Department of Energy Office of Military Application (OMA), describes the Task Two efforts of Contract DE-AC01-85DP20133. It addresses the software packages that constitute the OMA automated data base management system (DBMS) developed by ARINC Research Corporation. Off-the-shelf software adapted for these efforts and the software written by ARINC Research specifically for the project are also described. In addition to providing details about the DBMS software, the report includes and OMA DBMS User's Guide to be employed as a reference manual by OMA. The report was prepared after an approximately ten-month period devoted to user evaluation of the system.

50337 **(LBL-PUB—3043) User's guide for the training database system: Version 2.1.** Konrad, A. (Lawrence Berkeley Lab., CA (USA)). 2 Apr 1986. Contract AC03-76SF00098. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88016653/JAW.

The LBL Training database was implemented at the request of the Environmental Health and Safety Deptartment for safety training courses. However, it is a generalized system that can serve the needs of general training administration as well. The purpose of the Training database system is to maintain current descriptive information about courses and students (whether LBL employees or not). It allows non-LBL employees to be included and provides data elements for off-site addresses. Such data as student identification, course name, course data, and sponsoring agency is made available without requiring users of the Training system also to maintain employee information such as student name, mailstop, termination dates, payroll account number, etc. The intent is to alleviate the burden of having to maintain general employee information on users of specialized databases. Such unnecessary redundancy in employee-related databases at the Laboratory consumes an inordinate amount of maintenance effort. The Training database system makes use of a maintained database of LBL employee information.

50338 **(LBL-PUB—3056) User's guide for the DOE/GSA ADPE [Automated Data Processing Equipment] inventory database system at LBL: Version 1.1.** Konrad, A. (Lawrence Berkeley Lab., CA (USA)). 21 Mar 1986. Contract AC03-76SF00098. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88016655/JAW.

The ADPE Inventory database system was implemented to enable LBL to meet GSA and DOE ADPE inventory reporting requirements and to meet its own ADP management needs. It makes use of the SPIRES database management system, an IBM-compatible PC, YTERM and RELAY software. Extensive use of SPIRES protocols and formats have been made in order to meet stringent GSA data formatting requirements. In so doing, much of the interactive user support has been provided in the user interface so that users need to know very little about technical detail of DOE/GSA reporting requirements and procedures and virtually nothing about SPIRES. This document provides a brief sketch of required tasks and how to accomplish them. It should be used in conjunction with the Automated Data Processing Equipment/Data System System Reference Manual, by DOE, which contains descriptions of the constraints on the values of each data element. Those constraints are not repeated in this manual and they may change from time to time.

50339 **(LBL-PUB—3057) User's guide for the ENGNOTE database system for LBL engineering notes: Version 1.2.** Konrad, A. (Lawrence Berkeley Lab., CA (USA)). 30 Jul 1986. Contract AC03-76SF00098. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88016652/JAW.

The ENGNOTE database was implemented at the request of the Mechanical Engineering Department for management of LBL engineering notes. It was converted from an LBL BKY program called ARDIE which was supported on the CDC 7600 in batch mode. The user interface was printed listings. In contrast, the current ENGNOTE database is interactive, though printed listings are easily produceable. ENGNOTE is implemented using the SPIRES database management system, a product of Stanford University, support by LBL on the U.C. Berkeley campus IBM 3090 computer. There is no practical limit to the number of records which may be contained in the database.

50340 **(ORNL/DSRD/TM—23) Business Modeling System (BMS) users manual.** Pennewell, W.J.; White, S.A.; Mott, T.B. (Oak Ridge National Lab., TN (USA). Data Systems Research and Development Program). Aug 1988. Contract AC05-84OR21400. 115p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88014772/JAW.

The Business Modeling System (BMS) Users Manual was produced for the NAVMIPPS Project Office (CODE 5N) of the Navy Finance Center (NAVFINCEN) by members of the Martin Marietta Energy Systems Navy Military Integrated Personnel and Pay Strategy (NAVMIPPS) Project Team. The manual was developed to aid users of the Business Modeling System which was previously delivered to the NAVFINCEN Operations Directorate (CODE 6) by the NAVMIPPS Project Team. The BMS comprises CODE 6 data and a set of dBASE III PLUS programs which were developed to store the data in varying formats designed to aid in the formulation and evaluation of CODE 6 reorganization options. This user manual contains instructions for database installation, online query, and preformatted report program use. Appendix A is a list of the thirty-two CODE 6 suborganizations from which the BMS data were collected. Appendix B is BMS MENU/FUNCTION HIERARCHY. Appendix C is a compilation sample report output.

50341 **(UCRL—98953) An extended nodal figure method for building large database assemblies from reduced entity sub-assemblies.** Everitt, D.A.; Sackett, J.G. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 9p. (CONF-8809102—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013102/JAW.

From International annual computervision user conference; San Diego, CA, USA (18 Sep 1988).

This paper describes a procedure for replacing high entity count sub-assemblies in large database assemblies with reduced entity parts without losing associativity to the full entity part. With a clever use of part naming conventions the full entity part can be copied to a new name and be stripped of non-essential entities. The remaining entities carry all the information for orientation, mounting, and outer envelope size. This part can then be inserted in the higher level assembly as an extended nodal figure. With the full entity part also prepared as an extended nodal figure, the "REPLACE NFIG" command can be used to retrieve full entity part information at the higher assembly level. The entire higher level assembly can be built from reduced entity NFIGs with the ability to temporarily retrieve full entity information at specific locations.

50342 **A survey of information authentication.** Simmons, G.J. (Sandia National Labs., Albuquerque, NM (US)). *Proceedings of the IEEE (Institute of Electrical and Electronics Engineers);* 76: No. 5, 603-620(May 1988).

In deference to the origins of the problem of authentication in a communications context, the authors refer to the authenticated information as the message and, to the originator (of a message) as the transmitter. The message, devoid of any meaningful physical embodiment, is presented for authentication by a means that the they call the authentication channel. This channel is by definition insecure, i.e., all communications that pass through it are public and may even be intercepted and replaced or altered before being relayed on to the intended receiver. In the simplest possible authentication scheme the party receiving the message (the receiver) is also the one wishing to verify its authenticity; although, there are circumstances in which this is not the case. Authentication, however, is much broader than this communications based terminology would suggest. The information to be authenticated may indeed be a message in a communications channel, but it can equally well be data in a computer file or resident software in a computer; it can be quite literally a fingerprint in the application of the authentication channel to the verification of the identity of an individual or figuratively a "fingerprint" in the verification of the identity of a physical object such as a document or a tamper sensing container. In the broadest sense, authentication is concerned with establishing the integrity of information purely on the basis of the internal structure of the information itself, irrespective of the source of that information.